3001 0406100018

CH2M HILL
Mound, Inc.
1 Mound Road
P.O. Box 3030
Miamisburg, OH
45343-3030

CH2MHILL

ER-085/03
June 26, 2003

Mr. Richard B. Provencher, Director
Miamisburg Closure Project
U. S. Department of Energy
P. O. Box 66
Miamisburg, OH 45343-0066

SUBJECT: Contract No. DE-AC24-03OH20152
Contract Deliverable 039 - PRS Documents
PRS 64, 397 & 417 PACKAGES, FINAL

Dear Mr. Provencher:

Paul Lucas from your office has approved the release of the following documents:

- PRS 64 Package, Final
- PRS 397 Package, Final
- PRS 417 Package, Final

The responses to public comments on these packages have been approved by the Core Team and are included in the final packages. These packages are therefore submitted as the final administrative records for these NFA PRSs. If you have any questions regarding the documents, please contact Dave Rakel at Extension 4203.

Sincerely,

Monte A. Williams
Deputy Project Manager, Environmental Restoration

MAW/KMA/jdg

Enclosure

Approved: Paul Lucas 6/25/03
Paul Lucas Date
CERCLA Program Manager

cc: David Seely, USEPA, (1) w/attachments
Brian Nickel, OEPA, (1) w/attachments
Ruth Vandegrift, ODH, (1) w/attachments
Danny Punch, DOE/MCP, (1) w/attachments
Lisa Rawls, DOE/MCP, w/o attachments
Randy Tormey, DOE/OH, (1) attachments
Terrance Tracy, DOE/HQ, (1) w/attachments
Dann Bird, MMCIC, (3) w/attachment
J. D. Bonfiglio, MESH, (1) w/attachment
Monte Williams, CH2M HILL, (1) w/attachments
John Fulton, CH2M HILL, w/o attachments
Gene Valett, CH2M HILL, w/o attachments
Dave Rakel, CH2M HILL, w/o attachments
Public Reading Room, (4) w/attachments
Admin Records, (2) w/attachments
DCC, (1) w/attachments

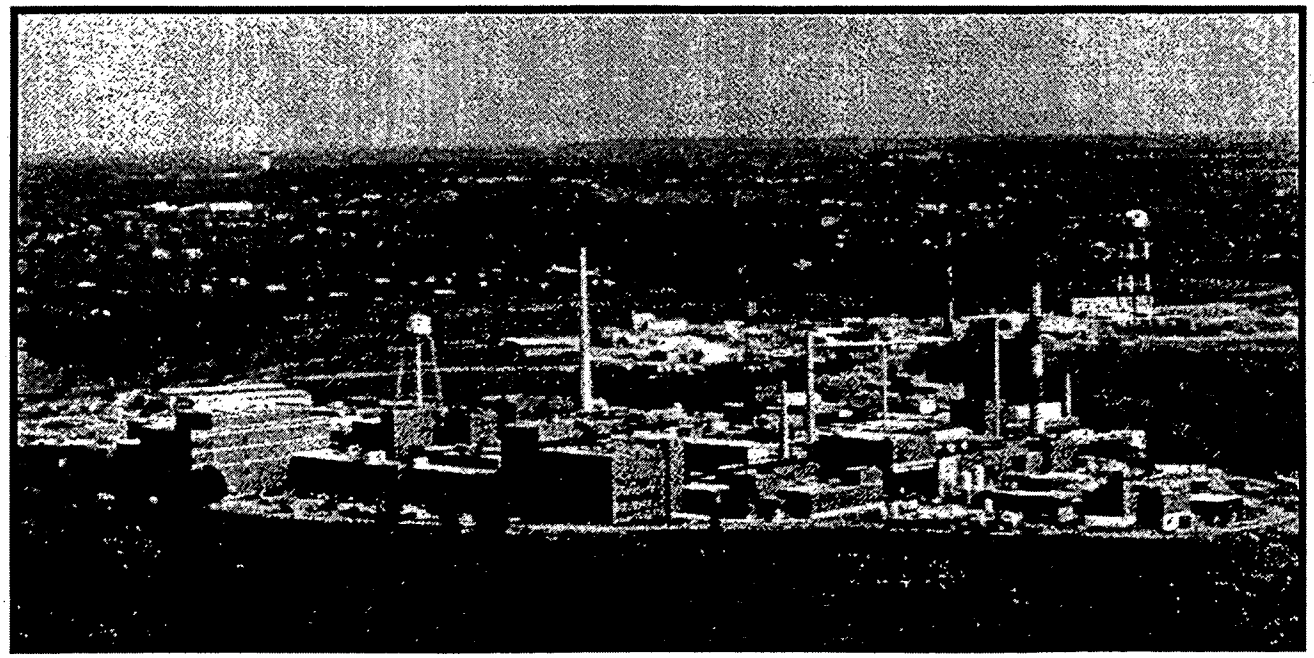
MOUND

Environmental
Restoration
Program

Miamisburg Closure Project
Potential Release Site Package

PRS 64

Final
June 2003



The Mound Core Team
P.O. Box 66
Miamisburg, Ohio 45343-0066

June 2003

Mr. Daniel Bird, AICP
Planning Manager
Miamisburg Mound Community Improvement Corporation
720 Mound Road
COS Bldg. 4221
Miamisburg, Ohio 45342-6714

Dear Mr. Bird:

The Core Team, consisting of the U.S. Department of Energy Closure Project (DOE-MCP), U.S. Environmental Protection Agency (USEPA), and the Ohio Environmental Protection Agency (OEPA), appreciates your comment on the PRS 64 Public Review Draft Package. Attached is our response.

Should the response to comments require additional detail, please contact Paul Lucas at (937) 847-8350 extension 314 and we will gladly arrange a meeting or telephone conference.

Sincerely,

DOE/MCP:	Paul Lucas	6/18/03
	Paul Lucas, Remedial Project Manager	date
USEPA:	David P. Seely	6/24/03
	David P. Seely, Remedial Project Manager	date
OEPA:	B. K. Nickel	6/18/03
	Brian K. Nickel, Project Manager	date

Response to Public Comments

from MMCIC
on PRS 64 Public Review Draft Package
February 2003

Comment 1. From our review of the PRS 64 Public Review Draft, MMCIC concurs that a No Further Assessment response is appropriate for this PRS. MMCIC understands that the underground storage tank associated with the PRS was confirmed removed, and subsequent soil sampling showed TPH and BTEX results were below screening levels.

Response 1. Thank you for your review and support of a No Further Assessment decision. MMCIC's understanding, as stated above, is consistent with that of the Core Team.

Environmental Restoration Program

MIAMISBURG CLOSURE PROJECT
POTENTIAL RELEASE SITE PACKAGE
Notice of Public Review Period

The following Potential Release Site (PRS) packages are available for public review in the CERCLA Public Reading Room, 305 E. Central Ave., Miamisburg, Ohio. Public comment on these documents will be accepted 26 February 2003 through 27 March 2003.

PRS 41: Area 3 Thorium Drum Storage/Redrum
PRS 64: Building 19 Historic Gasoline Tank
PRS 397: Soil Contamination

Questions can be referred to Paul Lucas at (937) 865-4578

PRS 64 Package Tracking Sheet

REVISION	DESCRIPTION	DATE
Working Draft (to DOE)	Binned FA on 2 October 1996.	
Draft (to Core Team)		
Draft Proposed Final	Addendum 1 submitted to CT to summarize FA results. USEPA comment was add table of max detects. OEPA comments included TPH explanation of calculations. PRS binned NFA on February 19, 2003. Added Addendum 1 to original package and submitted as public review draft.	**January 2003**
Public Review Draft	Public review period: 26 Feb to 27 Mar 03	**February 2003**
Final	There were no public comments that required changes to the document.	**June 2003**

ADDENDUM 1

SUPPORTING NFA RECOMMENDATION

MOUND

Environmental
Restoration
Program

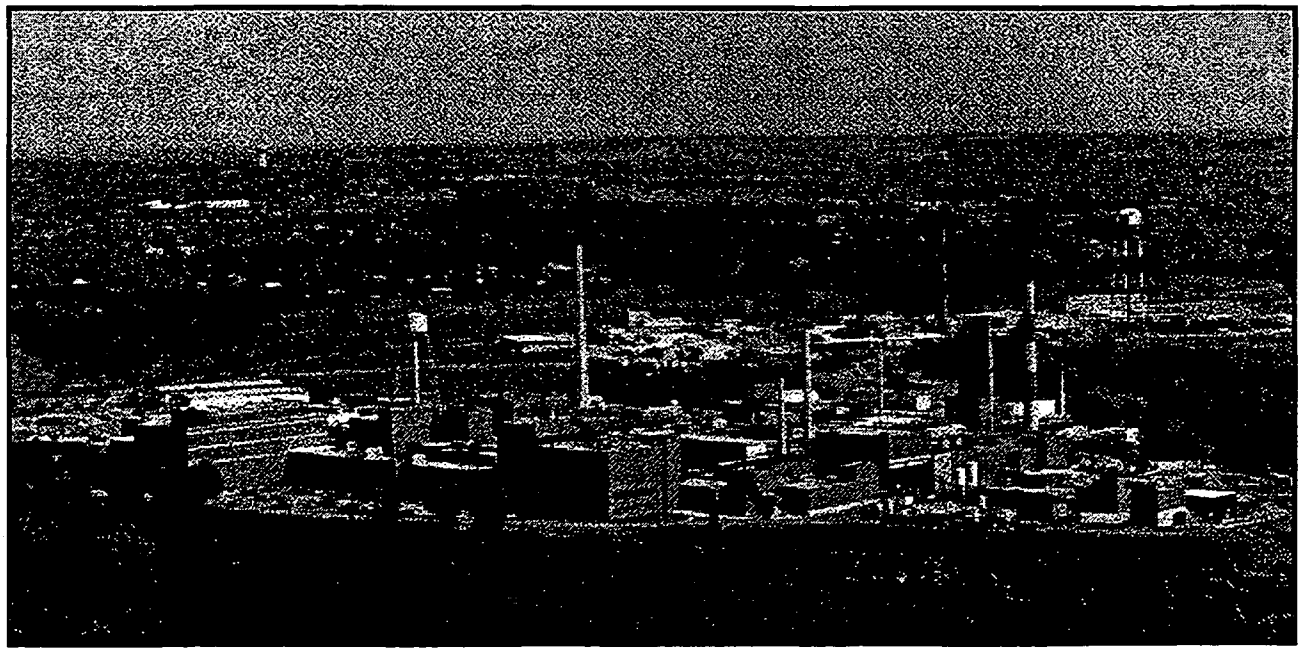
Miamisburg Closure Project

Potential Release Site Package

PRS 64

Addendum 1

Final
June 2003



PRS HISTORY:

Potential Release Site (PRS) 64 is located on the western portion of the site (Figure 1) and was binned Further Assessment (FA) by the Core Team on 2 October 1996. PRS 64 is the location of an underground storage tank that was reportedly removed but soil sampling results could not be found.

FURTHER ASSESSMENT ACTIVITY:

PRS 64 sampling was grouped with PRSs 41 and 417 due to their proximity to each other. This addendum applies to PRS 64 only. The potential contaminants of concern (COCs) for PRS 64 were BTEX (benzene, toluene, ethylbenzene, and xylene) and TPH (total petroleum hydrocarbon).

A metal detector was used to confirm that the tank was removed. Further Assessment sampling was completed in November 2002 per the Sampling and Analysis Plan (**SAP**)[1] approved by the Core Team.

Ten soil samples and one duplicate sample were analyzed for the COCs. The FA sample locations are presented in Figure 2. The FA **Data Report**[2] presents a full account of soil sampling activities and sample results.

There were no **BTEX** results above the screening levels in any sample. All results were below the detection limit except one detection of xylene. All detection limits were significantly below the more restrictive of the 10^{-6} Risk-Based Guideline Value (RBGV) or the Hazard Index of one value. One xylene result was reported at the detection limit of 6 mg/kg. The detection was not a concern when compared to the screening level for xylene in soil (430,000 mg/kg). The potential leachability of the xylene was also assessed and confirmed that it would not leach to the groundwater at unacceptable levels.

The maximum **TPH** result of 470 mg/kg did not exceed the former action level of 642 mg/kg (category 2 soil) prescribed in the 1992 Bureau of Underground Storage Tank Regulations (BUSTR)[3]. The calculations in BUSTR include site specific characteristics such as soil type (category). Other factors used in the calculations include distance to sensitive receptors, depth to groundwater, etc. TPH results are analyte non-specific with respect to the hazardous components of gasoline and as such, are no longer a chemical of concern in the revised (1999) BUSTR.[4]

Table 1: Maximum Detections (mg/kg)

Analyte	Result	Screening Level for Soil	Soil Screening Level for Groundwater
Xylene	6	430,000	1,368
Total Petroleum Hydrocarbons	470	642	Not Calculated

FIGURES:

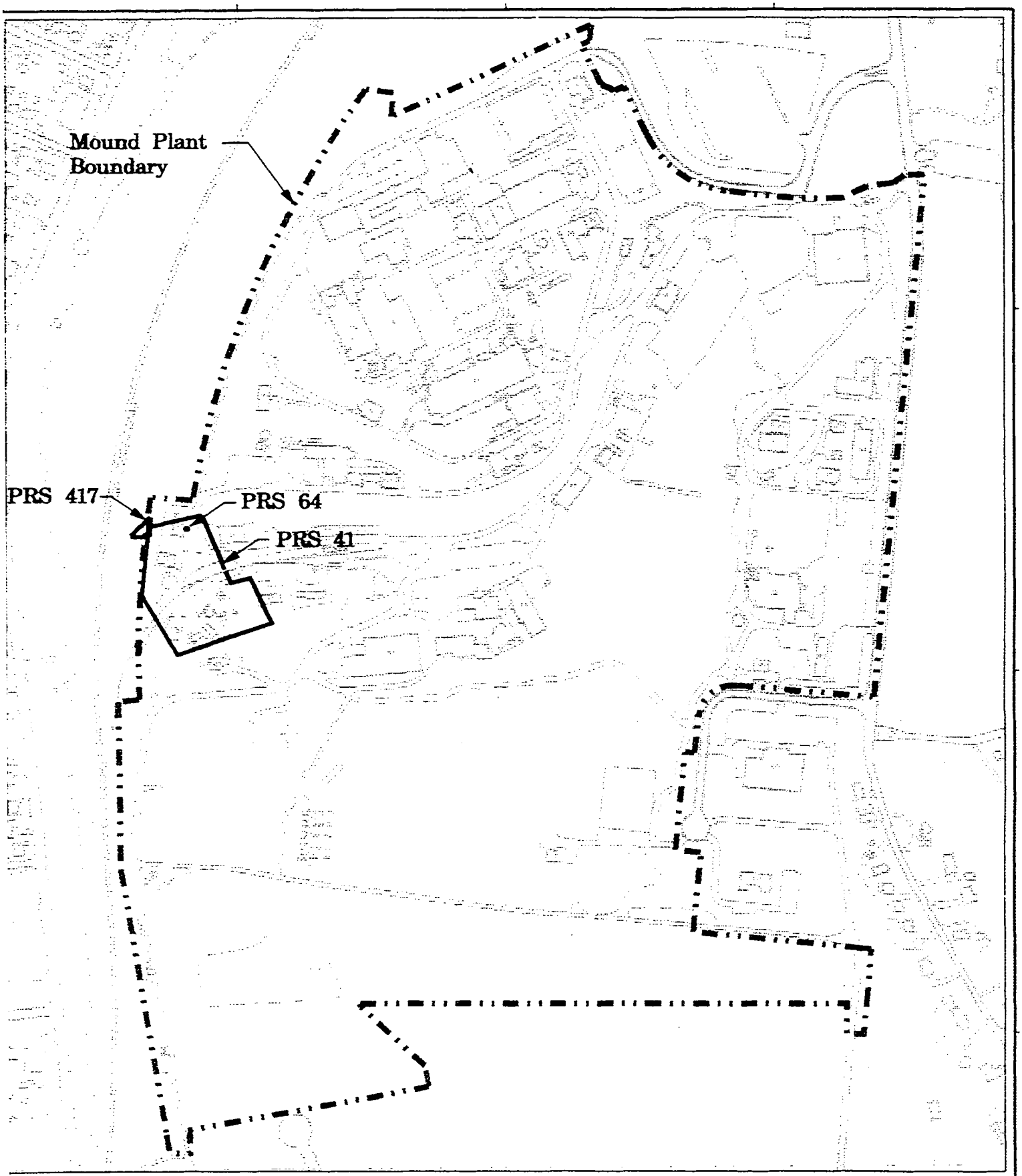
Figure 1: Location of PRS 41/64/417
Figure 2: PRS 64 Sample Locations

REFERENCES:

1) PRS 41/64/417 Sampling and Analysis Plan, Final, November 2002
2) PRS 41/64/417 Data Report, Rev. 0, December 2002
3) Ohio Administrative Code (OAC); 1301:7-9-13, effective 1 September 1992, Petroleum UST Corrective Action
4) Ohio Administrative Code (OAC); 1301:7-9-13, effective 31 March 1999, Petroleum UST Corrective Action

PREPARED BY:

Karen M. Arthur, CH2MHill, ER QA
Gary Miller, CH2MHill, ER Technical Staff



Legend

Structures
Paved roadway
Unpaved roadway
Mound Plant boundary
Railroad

0 100 200 400 600 800 1000
Scale in Feet

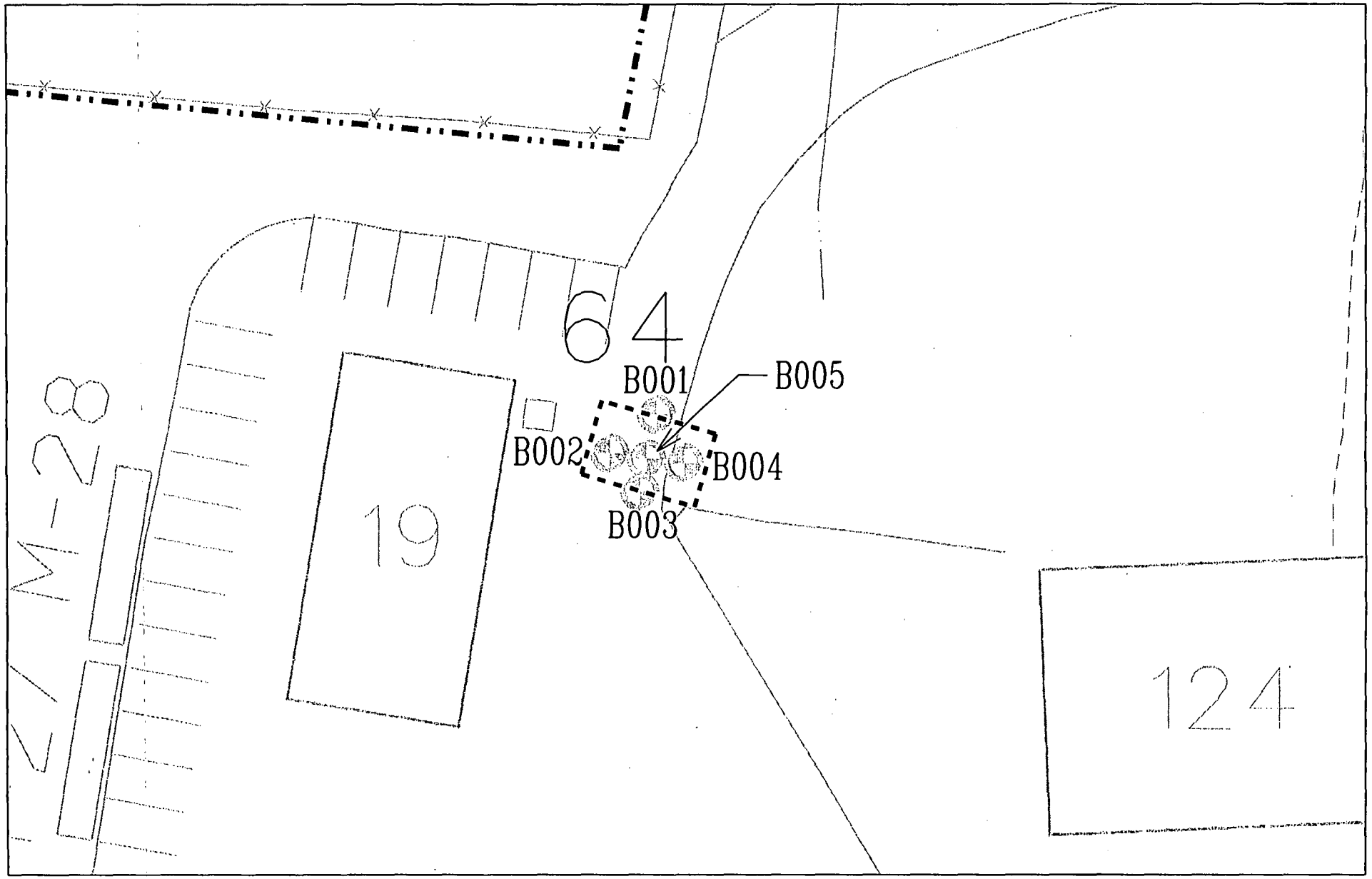
DATE	REVISION	BY	CHKR	ENG	UNIT	APVD
06/24/02	*	SSP				

MOUND
Environmental Restoration Geographic Information System

SHEET 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
ISSUE
SHEET 1 2 3 4 5 6
ISSUE
PART CLASSIFICATION

Figure 1: Location of PRS 41/64/417

DRAWING CLASSIFICATION: UNCLASSIFIED
SIZE
DRAWING NUMBER: gen_site_plan.dgn
JOB NUMBER
DWG TYPE: STE
PROJ: ER-GIS
CAGEC
SCALE
SHEET 1 OF
STATUS: MD-REL
ORIGIN: MSTATION / J



PRS 64 (BTEX, TPH) @ 5x2 intervals

20 10 0 20 40FT
GRAPHIC SCALE

MOUND
Environmental Restoration Geographic Information System

SHEET	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
ISSUE																					
SHEET	1	2	3	4	5	6															
ISSUE	*																				

PART CLASSIFICATION

Figure 2: PRS 64
Sample Locations

DRAWING CLASSIFICATION: UNCLASSIFIED
SIZE
DRAWING NUMBER: fig2_prs64.dgn
JOB NUMBER: *
DWG TYPE: STE
PRNG: ER-GIS
CAGEC
SCALE: *
SHEET 1 OF *
STATUS: MD-REL-01/15/03
ORIGIN: MSTATION / J

ISS	DATE	REVISION	BY	CHKR	ENG	LPREC	APVD	M
	01/15/03		SSF					

4 of 5

MIAMISBURG CLOSURE PROJECT
PRS 64

RECOMMENDATION:

Potential Release Site (PRS) 64 is located on the western portion of the site (Figure 1) and was binned Further Assessment (FA) by the Core Team on 2 October 1996. PRS 64 is the location of an underground storage tank that was reportedly removed but soil sampling results could not be found. Further Assessment was performed and confirmed that all sample results were below screening levels for BTEX and TPH.

Therefore, the Core Team recommends **No Further Assessment** for PRS 64.

A PRS Package with an NFA recommendation signed by the Core Team will be placed in the Public Reading Room for a 30-day review period. Upon closure of the public review comments, if any, the PRS Package will be issued as a final document and made available in the Public Reading Room.

CONCURRENCE:

DOE/MCP: _____ 2/19/03
Robert S. Rothman, Remedial Project Manager (date)

USEPA: _____ 2/19/03
David P. Seely, Remedial Project Manager (date)

OEPA: _____ 2/19/03
Brian K. Nickel, Project Manager (date)

ORIGINAL DOCUMENT

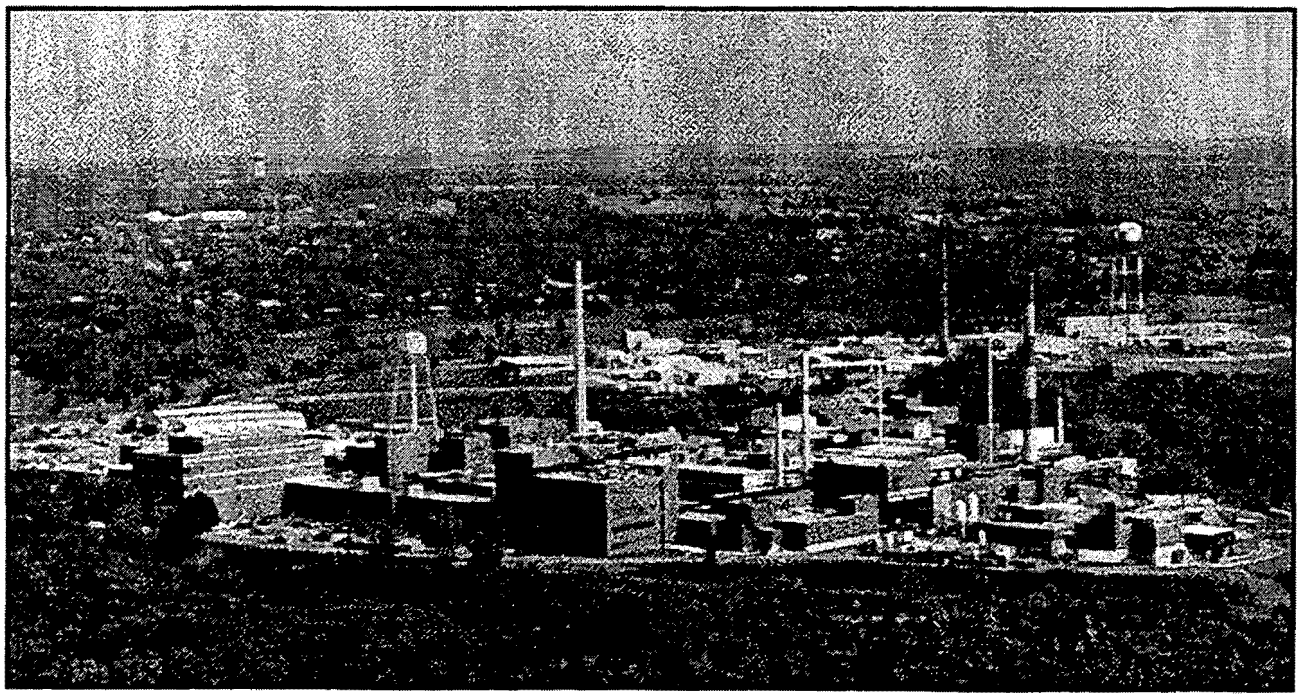
SUPPORTING FA RECOMMENDATION

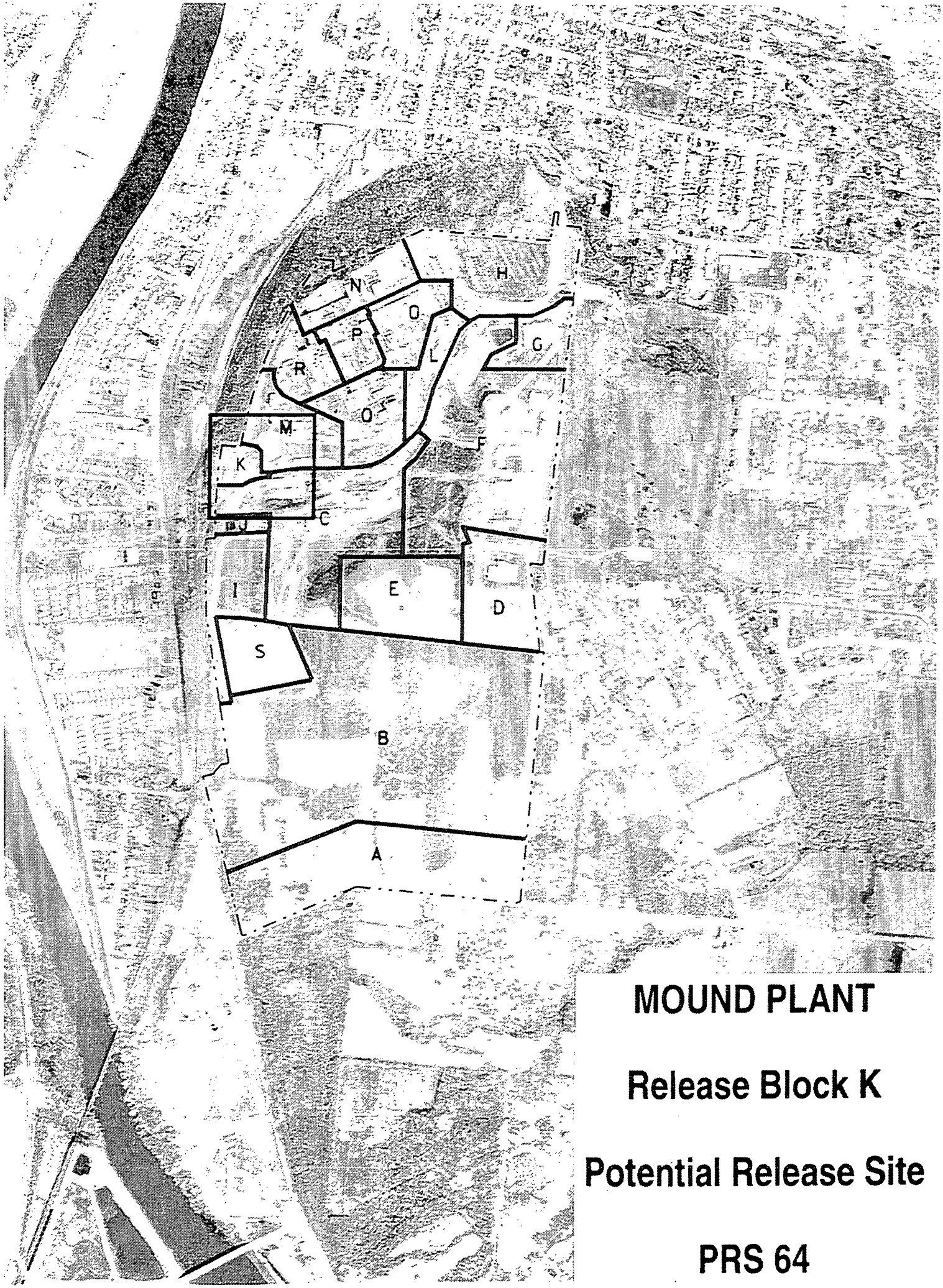
Environmental
Restoration
Program

MOUND PLANT

Potential Release Site Package

PRS # 64





MOUND PLANT

Release Block K

Potential Release Site

PRS 64

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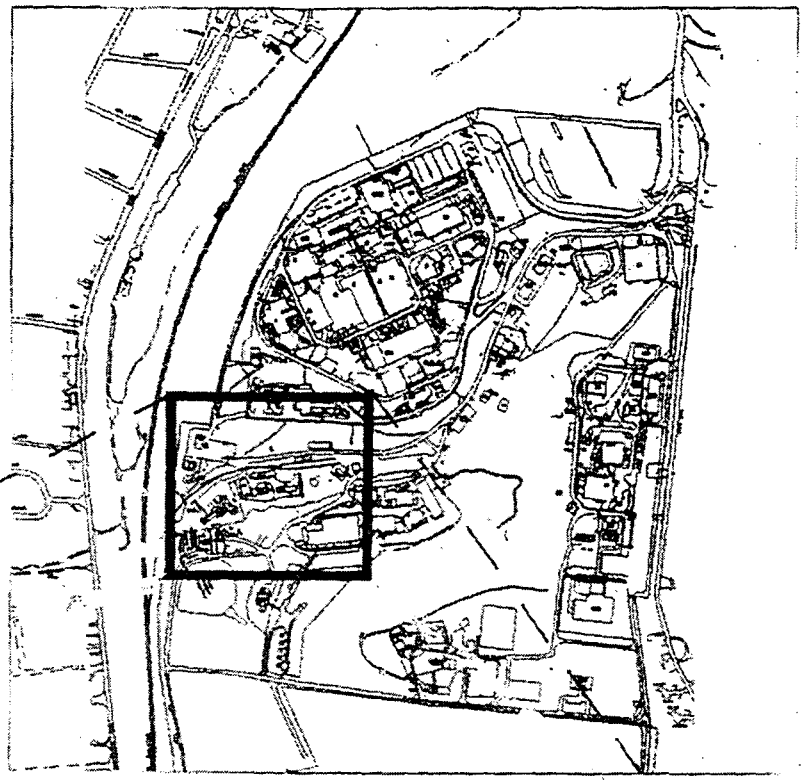
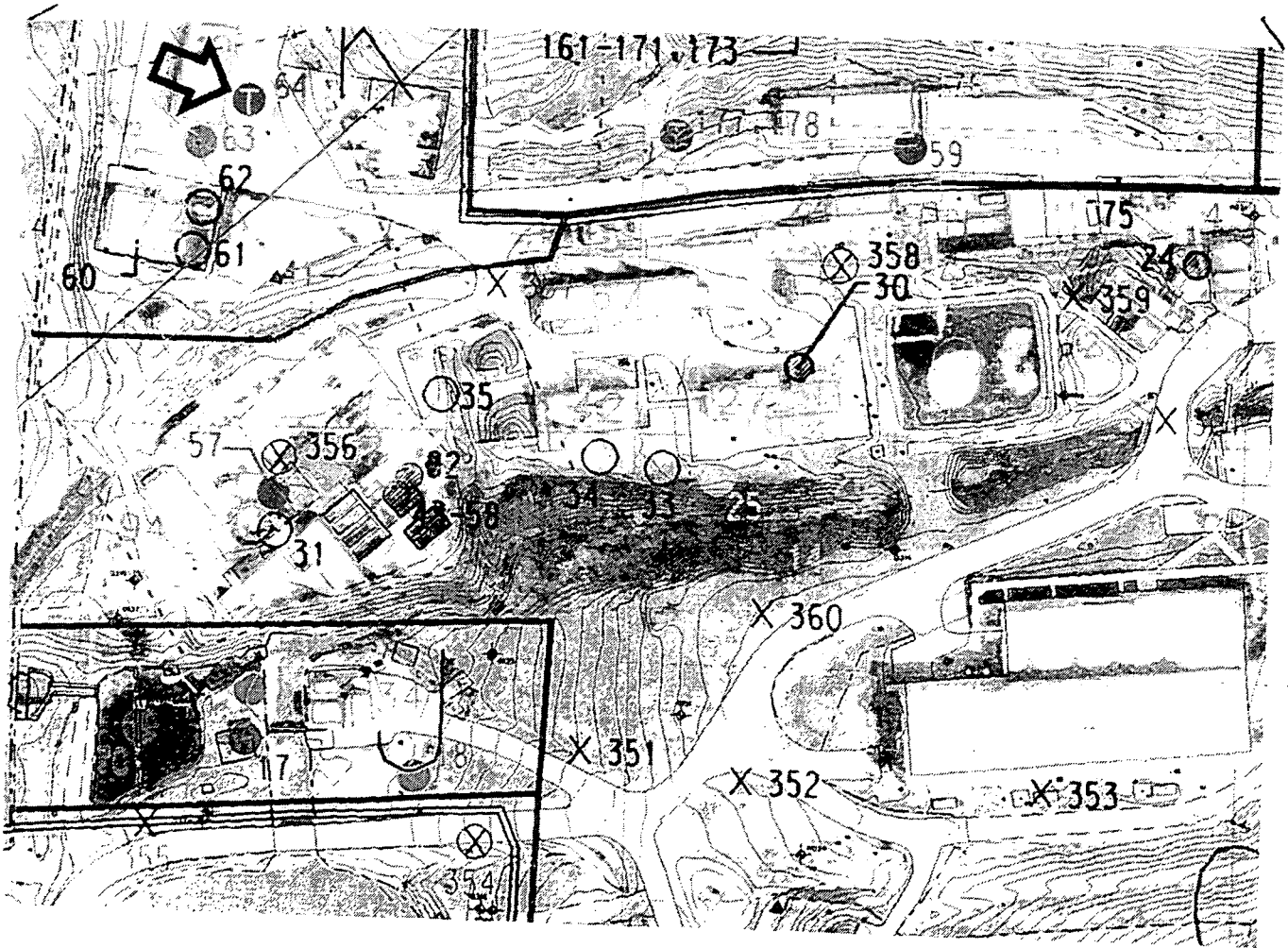
MOUND PLANT

Release Block K

Potential Release Site

PRS 64





64

PRS 64

PRS HISTORY:

Site is east of Building 19. Two gasoline pumps are visible on a historical drawing and in historic photographs dating back to 1947 and 1948.[5] This site was identified during the Mound Plant Underground Storage Tank Program and Regulatory Status Review as a result of a review of historic construction drawings. The number, volume and construction of the tank(s) has not been determined nor has documentation concerning closure of the tank(s) been found. It is believed that the tank(s) were removed, probably as part of original site construction demobilization.[2]

CONTAMINATION:

1) In 1983 through 1984, the ***Radiological Site Survey***[3] investigated Mound soils for radionuclides. As part of this investigation, one surface sample was taken at PRS 64 and analyzed for plutonium-238 and thorium-232. Results of the analysis are shown in the table below:

Contaminant	Maximum Concentration Detected	Guideline Criteria
Plutonium-238	5.94 pCi/g [ref 3] (in surface soil)	25 pCi/g (Mound ALARA in soil)
Thorium-232	Less than 2 pCi/g [ref 3] (in surface soil)	5 pCi/g [ref 8] (in surface soil)

NOTE: pCi = picocuries, g = grams, ALARA = As Low As Reasonably Achievable

2) In 1994, the ***OU5, Non-AOC Field Report***[4] field screened the soil surface in the vicinity of PRS 64. The field screening found no elevated levels of radioactivity in the soils. Therefore, no samples were collected for laboratory analysis.

   The ***OU5, Non-AOC Field Report***[4] also investigated volatile organic compounds (VOCs) in the vicinity of PRS 64 via a PETREX Soil Gas investigation. The PETREX investigation showed relatively high levels of petroleum, semivolatile and total aromatic hydrocarbons when compared to the surrounding soil areas.

3) In 1996, the ***Soil Gas Confirmation Investigation***[6] sampled the location of PRS 64 (sample #7) for volatiles, semivolatiles, PCBs, pesticides, metals, radionuclides, and explosives. Soil boring refusal was encountered at 18 inches. Results of the investigation showed:

   All concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives in the soils were below their respective ALARA, regulatory, or 10^{-6} Risk Based Guideline Criteria.[6, 7, 8]

READING ROOM REFERENCES:

1) Operable Unit 9, Site Scoping Report: Volume 12 - Site Summary Report, December 1994. (pages 5-7)
2) Mound Plant Underground Storage Tank Program Plan and Regulatory Status Review, November 1992. (pages 8-9)
3) OU9, Site Scoping Report: Volume 3 - Radiological Site Survey, Final, June 1993. (pages 10-12)
4) OU5, Operational Area Phase I Investigation, Non-AOC Field Report, Final, June 1995. (pages 13-20)
7) Risk-Based Soil Guidelines, Final, Revision 3, December 1995.

OTHER REFERENCES:

5) Comments on History of Area Around Present Location of Building 19. (pages 21-23)
6) Further Assessment, Soil Gas Confirmation Sampling, May 1996. (pages 24-34)
8) Code of Federal Regulations, 40 CFR 192.12 and 40 CFR 192.43.

PREPARED BY:

Gerald F. Maul, Member of EG&G Technical Staff

MOUND PLANT
PRS 64

RECOMMENDATION:

CONCURRENCE:

DOE/MB: _____
Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA: _____
Timothy J. Fischer, Remedial Project Manager (date)

OEPA: _____
Brian K. Nickel, Project Manager (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from _____ to _____.

☐ No comments were received during the comment period.
☐ Comment responses can be found on page _____ of this package.

REFERENCE MATERIAL
PRS 64

Document Control No. _____

Environmental Restoration Program

OPERABLE UNIT 9 SITE SCOPING REPORT: VOLUME 12 – SITE SUMMARY REPORT

MOUND PLANT
MIAMISBURG, OHIO

December 1994

Final

U.S. Department of Energy
Ohio Field Office

EG&G Mound Applied Technologies

Table A.1. Comprehensive Tabulation of Potential Release Sites

Description of History and Nature of Waste Handling						Hazardous Conditions and Incidents			Environmental Data		
No.	Site Name	Location	Status	Potential Hazardous Substances	Ref	Releases	Media	Ref	Analytes[a]	Results	Ref
63	Building 19 Soils	G-5	Grounds	Cobalt-60	10	Cobalt-60	S	10	1 14, 16	SGS[b] Table B.5 Location 5221 Table B.9 RSS[c] Locations C0099, C0100, S0530, S0532, S0533, S0534, S0535, S0538 (Appendix E in Ref. 6)	1 (
64	Building 19 Historic Gasoline Tank (Tank 238)	G-5	Historical	Gasoline	3	No information on when tanks were removed			No Data		
65	Building 61 Area, Former Heavy Equipment Area	E-10	Historical	Waste oil	1, 5, 7, 18	Suspected	S	7, 10	3, 4, 5, 6, 8 1 14	Tables B.6, B.7, B.8, and B.9 SGS[b], Table B.3 Locations 2216 and 2217 RSS[c] Locations S0233, S0234, S0235, S0236, S0237, S0240 (Appendix E in Ref. 6)	 1 (
66	Area 7, Thorium and Polonium Wastes	E-8 E-9 F-8 F-9	Historical	Plutonium-238, Thorium-232 and -238, Polonium-210, Actinium-227, Radium-226, Cesium-137	1, 4, 5, 18	Suspected	S	4, 12, 18	14, 15, 16 1	Table B.1 (Table III.5 in Ref. 6) SGS[b] Table B.3	 1

1 - Soil Gas Survey - Freon 11, Freon 113, Trans-1,2-Dichloroethylene, Cis-1,2-Dichloroethylene, 1,1,1-Trichloroethane, Perchloroethylene, Trichloroethylene, Toluene
2 - Gamma Spectroscopy - Thorium-228, -230, Cobalt-60, Cesium-137, Radium-224, -226, -228, Americium-241, Actinium-227, Bismuth-207, Bismuth-210m, Potassium-40
3 - Target Analyte List
4 - Target Compound List (VOC)
5 - Target Compound List (SVOC)
6 - Target Compound List (Pesticides/Polychlorinated Biphenyl)
7 - Dioxins/Furans
8 - Extractable Petroleum Hydrocarbons (EPH)/Total Petroleum Hydrocarbons (TPH)
9 - Lithium
10 - Nitrate/Nitrite
11 - Chloride
12 - Explosives
13 - Plutonium-238
14 - Plutonium-238, Thorium-232
15 - Cobalt-60, Cesium-137, Radium-226, Americium-241
16 - Tritium

Reference List

1. DOE 1986 "Phase I: Installation Assessment Mound (DRAFT)."
2. DOE 1992a "Remedial Investigation/Feasibility Study, Operable Unit 9, Site-Wide Work Plan (Final)."
3. DOE 1992c "Mound Plant Underground Storage Tank Program Plan & Regulatory Status Review (Final)."
4. DOE 1993a "Site Scoping Report: Vol. 7 - Waste Management (FINAL)."
5. EPA 1988a "Preliminary Review/Visual Site Inspection for RCRA Facility Assessment of Mound Plant"
6. DOE 1993d "Operable Unit 9, Site Scping Report: Vol. 3 - Radiological Site Survey (FINAL)."
7. DOE 1993c "Operable Unit 3, Misc. Sites Limited Field Investigation Report."
8. DOE 1992d "Reconnaissance Sampling Report Decontamination & Decommissioning Areas, OU6, (FINAL)."
9. Fentiman 1990 "Characterization of Mound's Hazardous, Radioactive and Mixed Wastes."
10. DOE 1992f "Operable Unit 9, Site Scpoing Report: Vol. 9 - Spills and Response Actions (FINAL)."
11. Styron and Meyer 1981"Potable Water Standards Project: Final Report."
12. DOE 1993b "Reconnaissance Sampling Report - Soil Gas Survey & Geophysical Investigations, Mound Plant Main Hill and SM/PP Hill (FINAL)."
13. DOE 1993d "Operable Unit 9, Site Scoping Report: Vol. 3 - Radiological Site Survey (FINAL)."
14. DOE 1991b "Main Hill Seeps, Operable Unit 2, On-Scene Coordinator Report for CERCLA Section 104 Remedial Action, West Powerhouse PCB Site."
15. Halford 1990 "Results of South Pond Sampling."
16. DOE 1993e "Operable Unit 4, Special Canal Sampling Report, Miami Erie Canal."
17. DOE 1990 "Preliminary Results of Reconnaissance Magnetic Survey of Mound Plant Areas 2, 6, 7, and C."
18. DOE 1992a "Remedial Investigation/Feasibility Study, Operable Unit 9, Site-Wide Work Plan (FINAL)."
19. Rogers 1975 "Mound Laboratory Environmental Plutonium Study, 1974."
20. DOE 1992h "Ground Water and Seep Water Quality Data Report Through First Quarter, FY92."
21. Dames and Moore 1976a, b "Potable Water Standards Project Mound Laboratory" and "Evaluation of the Buried Valley Aquifer Adjacent to Mound Laboratory."
22. DOE 1992i "Closure Report, Building 34 - Aviation Fuel Storage Tank."
23. DOE 1992j "Closure Report, Building 51 - Waste Storage Tank."
24. DOE 1994 "Operable Unit 1, Remedial Investigation Report."
25. EG&G 1994 "Active Underground Storage Tank Plan."

ENVIRONMENTAL RESTORATION PROGRAM

MOUND PLANT UNDERGROUND STORAGE TANK PROGRAM PLAN AND REGULATORY STATUS REVIEW

MOUND PLANT

MIAMISBURG, OHIO

November 1992

DEPARTMENT OF ENERGY

ALBUQUERQUE OPERATIONS OFFICE

ENVIRONMENTAL RESTORATION PROGRAM

EG&G MOUND APPLIED TECHNOLOGIES

FINAL (REVISION 0)

2.3.26. Building 19, Historic Gasoline Tank (Tank 238)

INCORRECT, SEE REF. (4) IN PRS UNDER "OTHER REFERENCES"

Built during the initial construction of Mound Plant in the 1940s, Building 19 is reported to have served as a vehicle service and maintenance facility for the Plant construction contractor (Kabot, 1992c). Two gasoline pumps at the facility are visible in a historical drawing, and are believed to have been supplied by a UST. The number, volume, and construction of the tank(s) have not been determined, nor has documentation concerning closure of the tank(s) been found, although it is believed that the tank(s) has been removed.

Because the historic gasoline tank(s) at Building 19 is thought to have been closed by removal, the existence of the tank(s) and any evidence of a release is subject to investigation by the ER Program (FFA) in Operable Unit 5.

2.3.27 Building 36, Historic Gasoline Tanks (Tanks 239 and 240)

A very old construction drawing (circa 1948) indicates that a fueling facility existed at the location of what is now Building 36. The drawing shows four pumps supplied by two USTs. The volume and construction of these tanks have not been determined, nor has documentation concerning closure of the tanks been found, although it is believed that the tanks have been removed.

Because the historic gasoline tanks at Building 19 are thought to have been closed by removal, the existence of the tanks and any evidence of a release is subject to investigation by the ER Program (FFA) in Operable Unit 5.

2.3.28 SM Building, Historic Septic Tank (Tank 241)

Historically, a sanitary septic tank located southeast of Building 30 served the SM Building. This tank is believed to have been constructed as a concrete vault, about 15 feet by 8 feet, and of unknown volume, that served the SM leach field downslope of the tank. Discharges to the tank took place from 1960 when it was built to 1964 when it was taken out of service and when the sanitary sewer connected to the sewage disposal facility. Overflow of the alpha wastewater system in room SM-1, may have contributed plutonium contamination to the tank and leach field. The D&D of the SM leach field originally included the removal of the tank, but the tank could not be located when excavation started. The tank may have been removed during an earlier construction project in the area (DOE, 1992c).

ENVIRONMENTAL RESTORATION PROGRAM

OPERABLE UNIT 9, SITE SCOPING REPORT: VOLUME 3 - RADIOLOGICAL SITE SURVEY

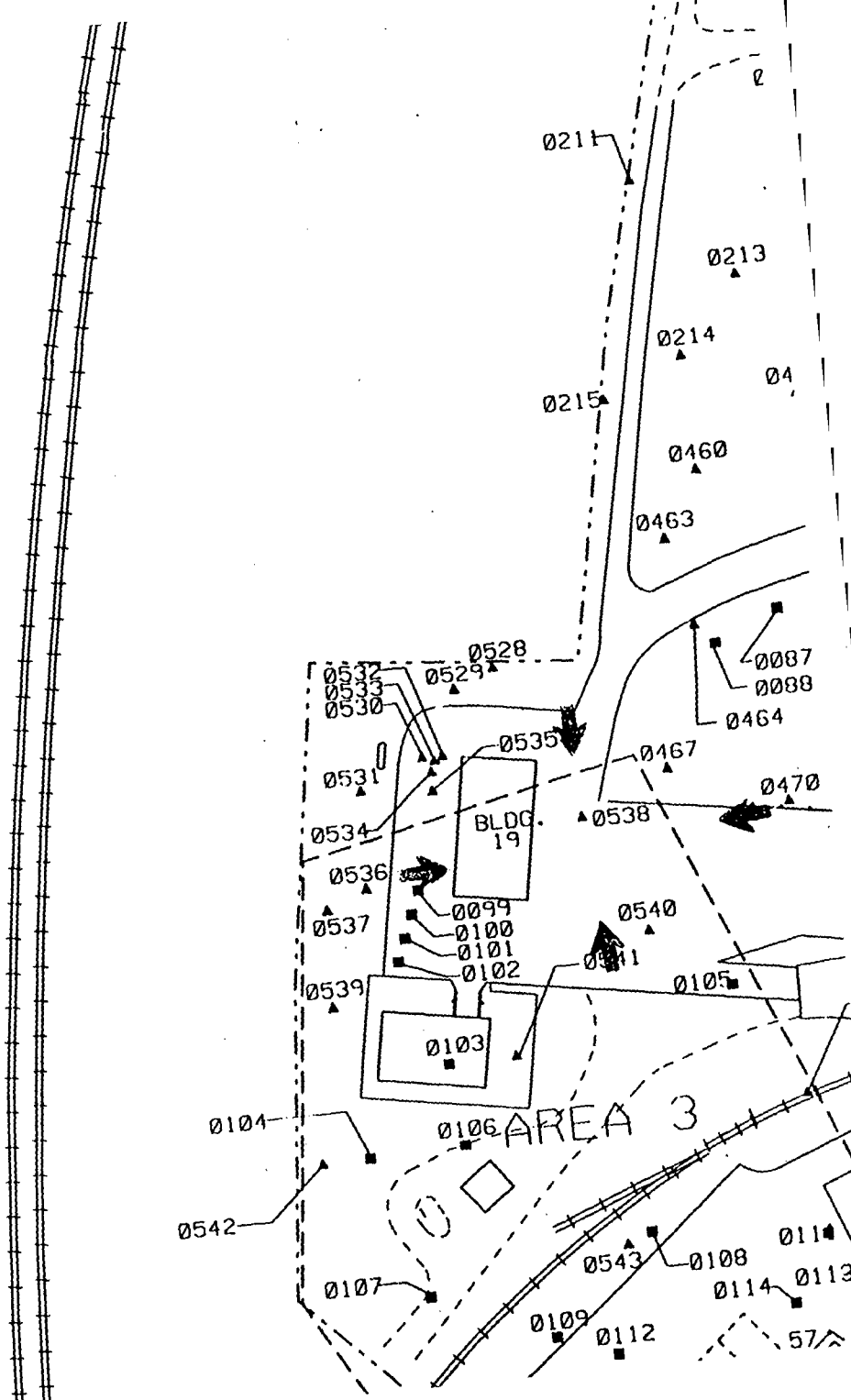
MOUND PLANT
MIAMISBURG, OHIO

June 1993

DEPARTMENT OF ENERGY
ALBUQUERQUE FIELD OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
EG&G MOUND APPLIED TECHNOLOGIES

FINAL


0211
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AREA 3
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Map Location[a]	Coordinates South	Coordinates West	MRC ID No.	Mo-Yr	Depth (inch)	Pu-238 (pCi/g)	Thorium[b] (pCi/g)	Tritium (pCi/mL)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Ra-226 (pCi/g)	Am-241 (pCi/g)
S0525	2675	4010	5891	07-84	0	0.59[c]	b					
S0526	2700	3860	2687	09-83	0	4.46	b					
S0527	2700	3935	5890	07-84	0	0.20	b					
S0528	1875	4165	7165	09-84	0	0.27	b					
S0529	1875	4190	7166	09-84	0	0.51	b					
S0530	1900	4225	10497	08-85	0	0.41	b					
S0531	1900	4265	2862	10-83	0	1.27	b					
S0532	1905	4215	10498	08-85	0	0.48	b					
S0533	1905	4220	10496	08-85	0	1.84	b					
S0534	1910	4225	10495	08-85	0	1.13	b					
S0535	1920	4230	10494	08-85	0	0.51	b					
S0536	1950	4290	7167	09-84	0	2.20	b					
S0537	1950	4315	2683	10-83	0	0.17	b					
C0099	1965	4265	10419	08-85	18	31.40	b					
			10420	08-85	36	14.70	b					
S0538	1975	4165	7165	09-84	0	5.94	b					
C0100	1975	4275	10421	08-85	18	32.40	b					
			10422	08-85	36	17.70	b					
			10423	08-85	54	12.40	b					
			10424	08-85	72	10.10	b					

Radiochemical Analysis

Document Control No._____

Environmental Restoration Program

OPERABLE UNIT 5
OPERATIONAL AREA PHASE I INVESTIGATION
NON-AOC FIELD REPORT

MOUND PLANT
MIAMISBURG, OHIO

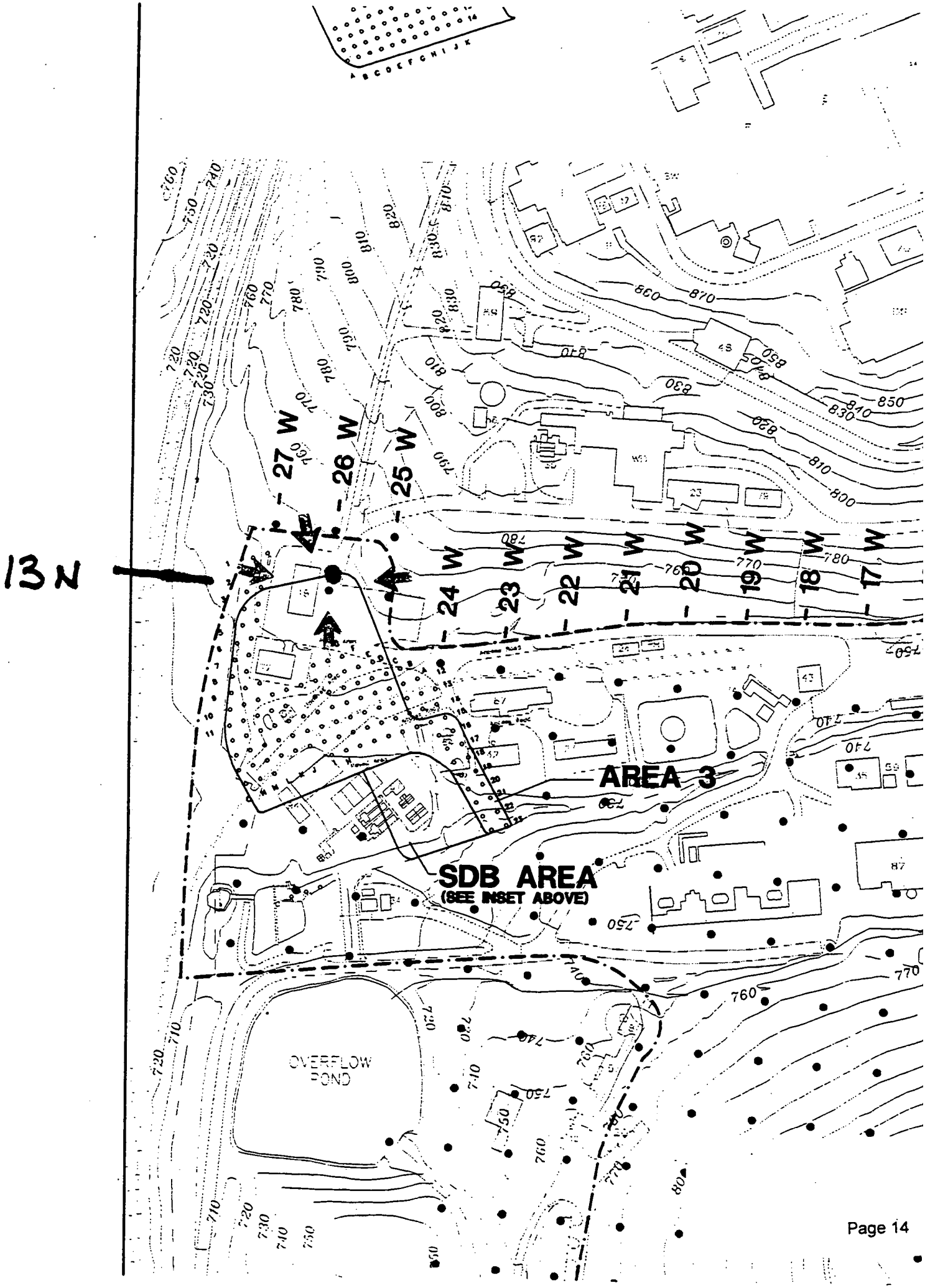
VOLUME II - APPENDICES A-G

June 1995

Final (Revision 0)

U.S. Department of Energy
Ohio Field Office

EG&G Mound Applied Technologies


13N
27 W
26 W
25 W
24 W
23 W
22 W
21 W
20 W
19 W
18 W
17 W
AREA 3
SDB AREA
(SEE INSET ABOVE)
OVERFLOW POND

FIDLER Data

Mound Soil Screen Data

APPENDIX D
RADIOLOGICAL DATA (FIDLER SURVEY MOUND SOIL SCREENING FACILITY DATA) FOR NON-AOC POINTS

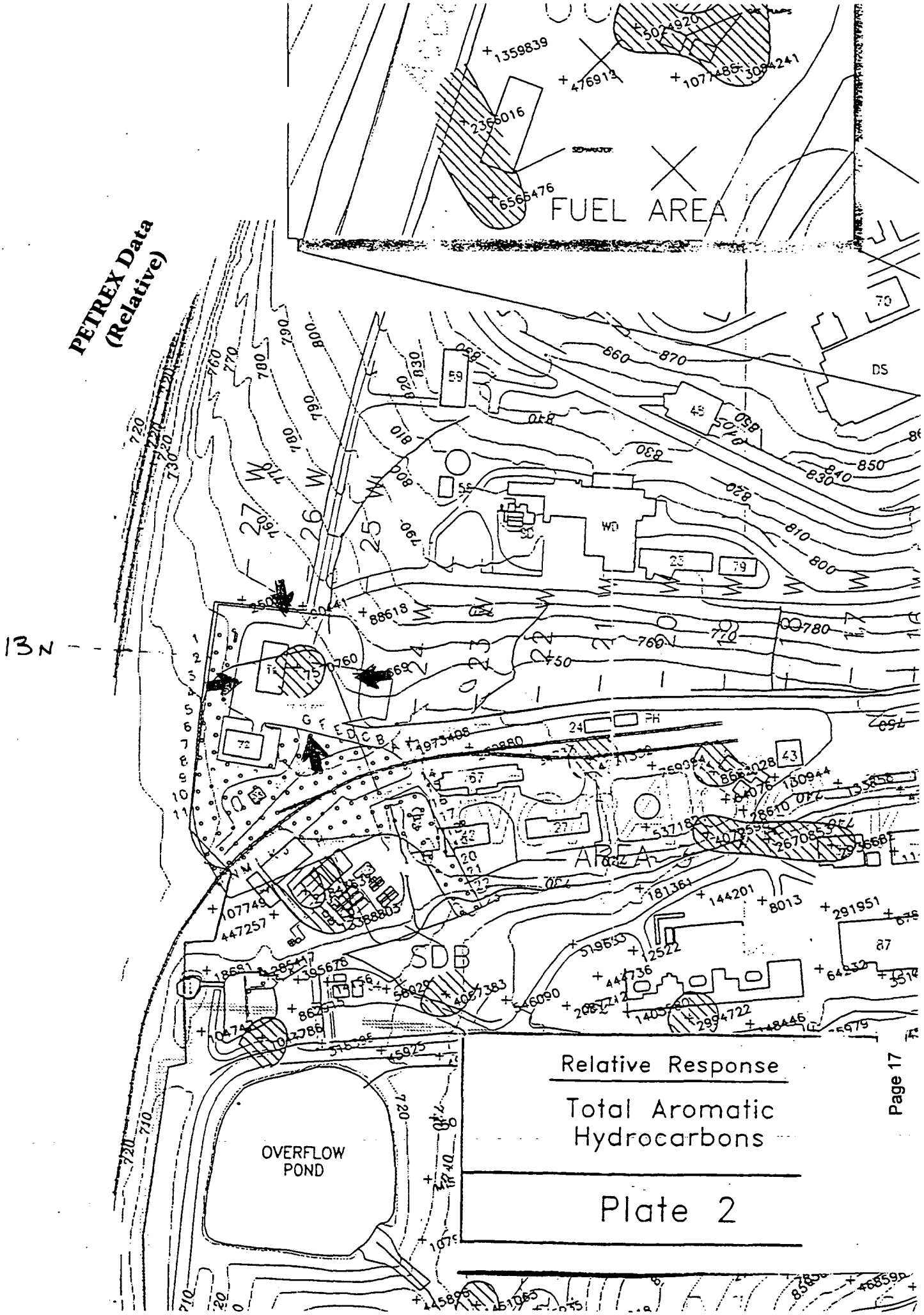
	FIDLER SURVEY DATA					MOUND SOIL SCREENING FACILITY DATA			
SMPID	Contamination Criteria CH1	FIDLER Readings CH1	Contamination Criteria CH2	FIDLER Readings CH2	FIDLER Readings Out Channel	Plutonium - 238		Thorium - 232	
	Units: CPM	Units: CPM	Units: KCPM	Units: KCPM	Units: KCPM	Units: pCi/g		Units: pCi/g	
	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	Note:	RESULTS	Note:
12N15	157.3	65	8.45	4.0	NC	85	b	0.9	a
12N16	157.3	110	8.45	5.5	NC	9	a	0.7	a
12N17	157.3	60	8.45	3.5	NC	WIPE	c	WIPE	c
12N18	157.3	60	8.45	4.5	NC	WIPE	c	WIPE	c
12N19	157.3	55	8.45	4.5	NC	19	a	0.5	a
12N20	157.3	65	8.45	4.5	NC	WIPE	c	WIPE	c
12N21	157.3	50	8.45	3.5	NC	WIPE	c	WIPE	c
12N22	157.3	85	8.45	5.5	NC	16	a	1	a
12N23	157.3	75	8.45	5.0	NC	WIPE	c	WIPE	c
12N24	157.3	40	8.45	3.5	NC	WIPE	c	WIPE	c
13N01	253.5	180	12.48	10.0	NC	15	a	1.1	a
13N02	253.5	95	12.48	4.5	NC	WIPE	c	WIPE	c
13N03	130	110	6.5	4.5	NC	WIPE	c	WIPE	c
13N25	157.3	40	8.45	4.0	NC	WIPE	c	WIPE	c
13N26	157.3	60	8.45	4.0	NC	WIPE	c	WIPE	c
14N01	253.5	100	12.48	7.0	NC	WIPE	c	WIPE	c
14N02	122.2	80	5.59	4.5	NC	WIPE	c	WIPE	c
14N03	130	75	6.5	5.0	NC	WIPE	c	WIPE	c
14N07	170.3	100	9.72	7.0	NC	NR		NR	
14N08	170.3	150	9.72	10.0	NC	NR		NR	
14N09	170.3	145	9.72	10.0	NC	NR		NR	
14N10	170.3	85	9.72	8.0	NC	NR		NR	
14N11	170.3	115	9.72	10.0	NC	NR		NR	
14N12	170.3	130	9.72	8.0	NC	NR		NR	
14N13	157.3	100	8.45	5.5	NC	NR		NR	
14N15	157.3	70	8.45	4.0	NC	WIPE	c	WIPE	c
14N25	157.3	85	8.45	7.0	NC	9	a	0.6	a
14N26	157.3	80	8.45	7.5	NC	8	a	0.7	a
14N27	157.3	150	8.45	9.0	NC	20	a	0.9	a

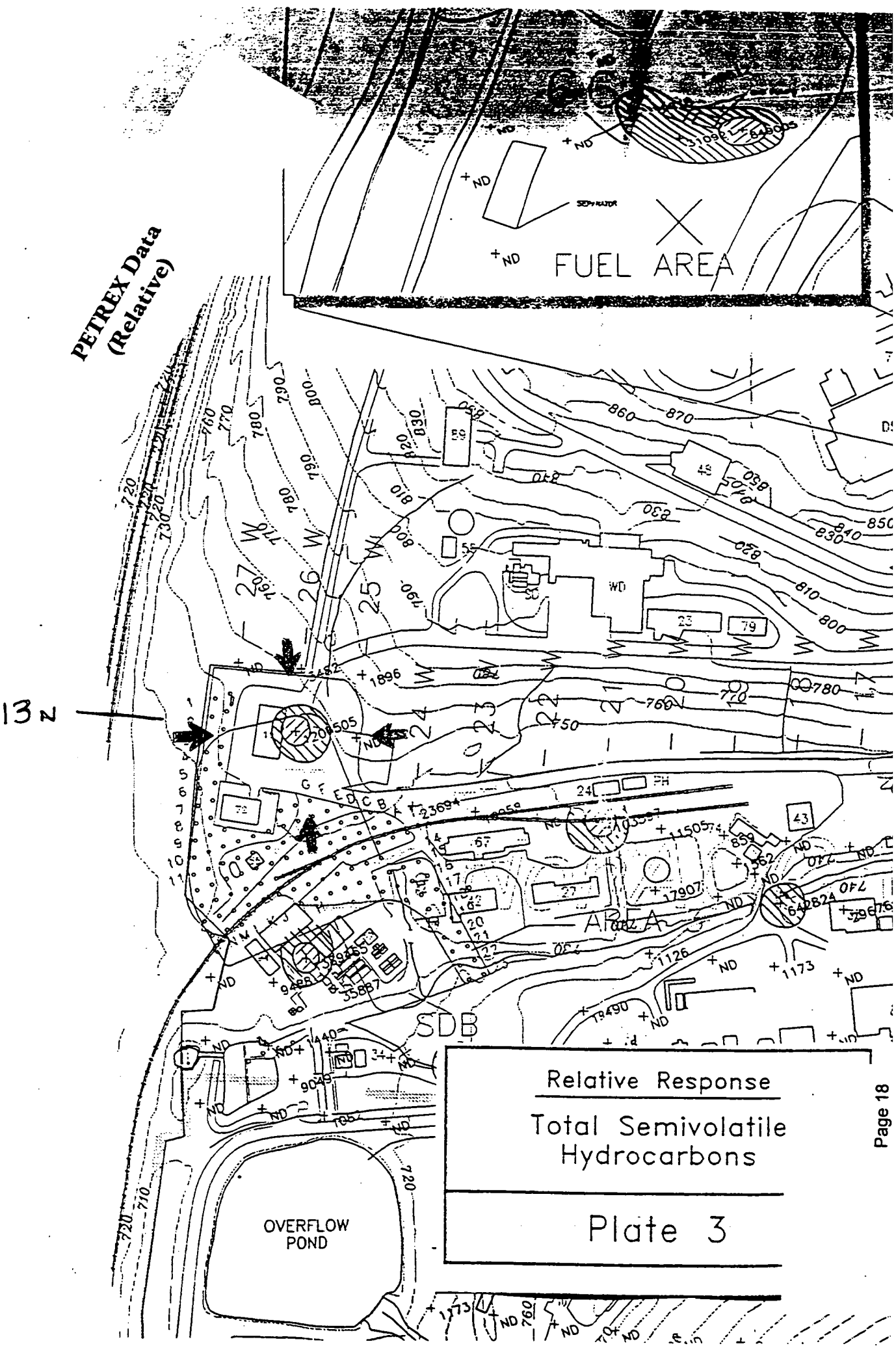
APPENDIX D

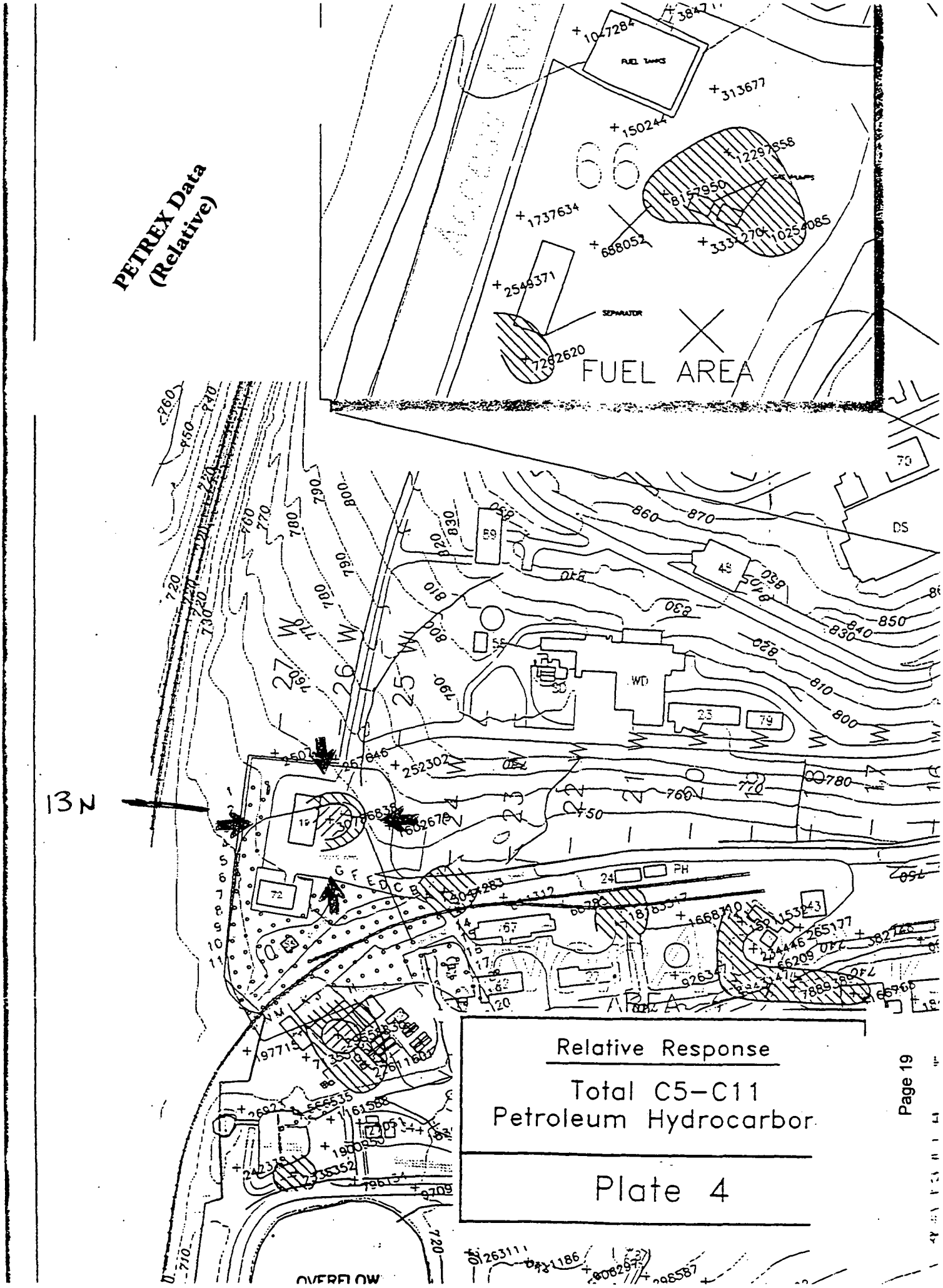
RADIOLOGICAL DATA (FIDLER SURVEY MOUND SOIL SCREENING FACILITY DATA) FOR NON-AOC POINTS

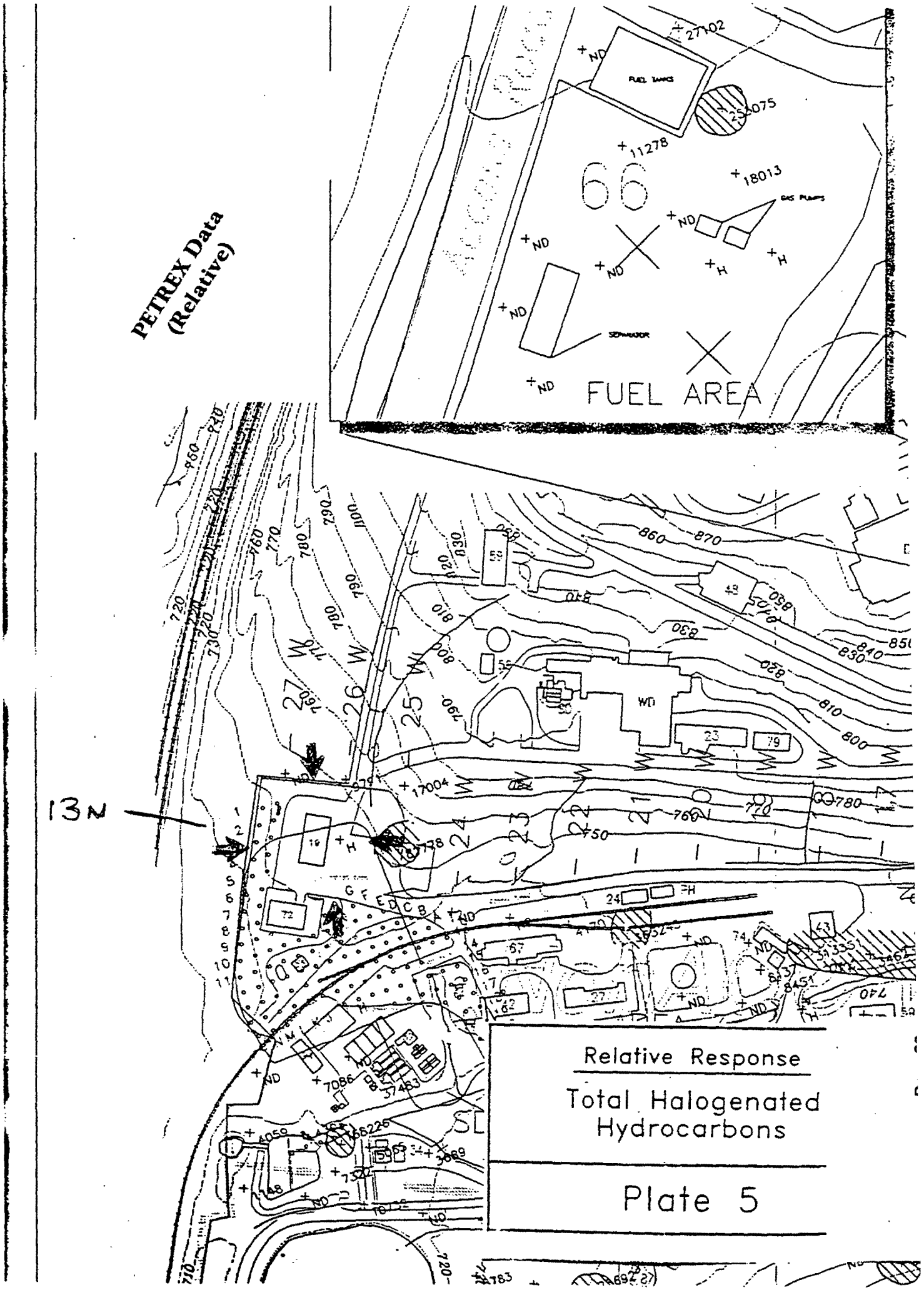
	FIDLER SURVEY DATA					MOUND SOIL SCREENING FACILITY DATA			
SMPID	Contamination Criteria CH1	FIDLER Readings CH1	Contamination Criteria CH2	FIDLER Readings CH2	FIDLER Readings Out Channel	Plutonium - 238		Thorium - 232	
	Units: CPM	Units: CPM	Units: KCPM	Units: KCPM	Units: KCPM	Units: pCi/g		Units: pCi/g	
	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	Note:	RESULTS	Note:

NR - Not recorded
NC - No sample/reading taken
NA - Reading not taken; contamination criteria not exceeded.
a - Mound Soil Screening Facility detection level not exceeded.
b - Concentration at or above the Mound Soil Screening Facility detection level.
c - Results of the wipe sample were less than 20 disintegrations per minute.
CPM - Counts per minute
KCPM - Counts per minute x 1000
pCi/g - Picocuires per gram


PETREX Data
(Relative)
FUEL AREA
13N
SDB
OVERFLOW
POND
Relative Response
Total Aromatic
Hydrocarbons
Plate 2


PETREX Data
(Relative)
FUEL AREA
13 N
OVERFLOW
POND
SDB
AREA
Relative Response
Total Semivolatile
Hydrocarbons
Plate 3


PETREX Data
(Relative)
FUEL AREA
FUEL TANKS
SEPARATOR
13 N
WD
DS
PH
OVERFLOW
Relative Response
Total C5–C11
Petroleum Hydrocarbor
Plate 4


PETREX Data
(Relative)
FUEL AREA
FUEL TANKS
GAS PUMPS
SEPARATOR
13N
Relative Response
Total Halogenated
Hydrocarbons
Plate 5

Barge, Waggoner, Sumner and Cannon, Inc.
January 19, 1996

Comments on History of Area Around Present Location of Building 19

Reference the following site drawing[1] of the Mound Plant in its early stages: the present site of Building 19 (shown dashed) overlaps the former maintenance garage. Note the gas pump and underground tank callouts to the southeast of the former maintenance garage.

[1]Drawing "General Plot Plan-Temporary Electric and Telephone", May 1947.

4	#12
5	#12
6	#2
7	#12
8	#6
8A	#12
9	#4
10	#10
11	#10
12	ON BUILDING LIGHTING ~~TIE~~
13	#12
14	#8
15	#12
16	#4
17	#4
18	#12
19	#2
20	#0
21	#0
22	#4
23	#4
23A	#10
[illegible]	#10
[illegible]	#0
[illegible]	#10
[illegible]	#4
[illegible]	#10

[illegible]	2#0 1#2 Neut.
24	2#4/0 1#2 Neut.
27	2#4/0 1#2 Neut.
25	2#4/0 1#2 Neut.
[illegible]	#4
[illegible]	[illegible]
13	#10
27	#4
Missing	#0
30	3#4
23	2#4/0 1#2
24	#8
29	#8
31	#4/0

UNCLASSIFIED

5-23-96

AUTHORIZED DERIVATIVE CLASSIFIER DATE

THIS SHEET CONTAINS INFORMATION FOR OFFICIAL USE ONLY AND MUST NOT BE TURNED OVER TO US MANAGERS OF CONTROL. MAXON CONSTRUCTION CO., INC. P.O. BOX 134, MIAMISBURG, OHIO

[redacted]

THIS DWG. SUPERSEDES DWG. No. MCC-11 2-3-41

GENERAL PLOT PLAN

TEMPORARY ELECTRIC & TELEPHONE

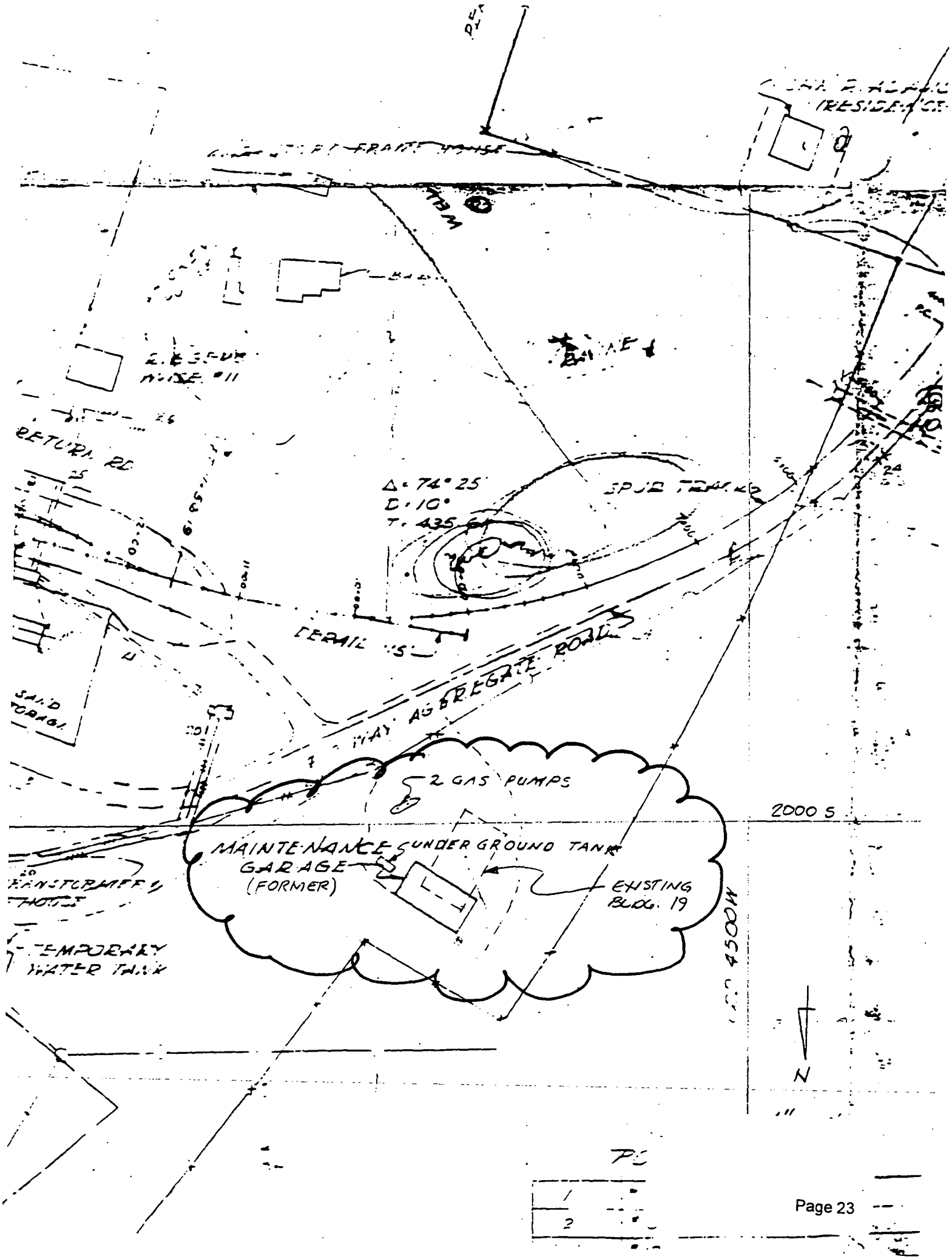
MAXON CONSTRUCTION CO., INC.

UNIT NO. 5 CONTRACT NO. W42-069 eng-101

MIAMISBURG, OHIO

SUPERSEDES | APPROVED BY

DRAWN BY | DRAWING NO. MCC-[illegible]


2 GAS PUMPS
MAINTENANCE GARAGE (FORMER)
UNDER GROUND TANK
EXISTING BLDG. 19
2000 S
4500 W
N
TEMPORARY WATER TANK
SAND STORAGE
RETURN RD
Δ = 74° 25'
D = 10°
T = 435.64'
SPUR TRAIL
TRAIL
MAY AGGREGATE ROAD
RESIDENCE
FRAME HOUSE
WELL
ELEVATOR HOUSE #11
TRANSFORMER HOUSE

MOUND

Environmental
Restoration
Program

Further Assessment

Soil Gas Confirmation Sampling

Mound Plant
Miamisburg, Ohio

May 1996

Revision 0

Department of Energy

EG&G Mound Applied Technologies

Table I.1 Soil Analyte List

Volatile Organic Compounds

Acetone	Dibromochloromethane	4-Methyl-2-Pentanone
Benzene	1,1-Dichloroethane	Styrene
Bromodichloromethane	1,2-Dichloroethane	1,1,2,2-Tetrachloroethane
Bromoform	1,1-Dichloroethene	Tetrachloroethene
Bromomethane	1,2-Dichloroethene (total)	1,1,1-Trichloroethane
2-Butanone	1,2-Dichloropropane	1,1,2-Trichloroethane-
Carbon Disulfide	cis-1,3-Dichloropropene	Trichloroethene
Carbon Tetrachloride	trans-1,3-Dichloropropene	Toluene
Chlorobenzene	Ethylbenzene	Vinyl Acetate
Chloroethane	2-Hexanone	Vinyl Chloride
Chloroform	Methylene Chloride	Xylenes (total)
Chloromethane		

Semivolatile Organic Compounds

Acenaphthene	Chrysene	Hexachlorobenzene
Acenaphthylene	Dibenz(a,h)anthracene	Hexachlorobutadiene
Anthracene	Dibenzofuran	Hexachlorocyclopentadiene
Benzo(a)anthracene	1,2-Dichlorobenzene	Hexachloroethane
Benzo(a)pyrene	1,3-Dichlorobenzene	Indeno(1,2,3-cd)pyrene
Benzo(b)fluoranthene	1,4-Dichlorobenzene	Isophorone
Benzo(g,h,i)perylene	3,3-Dichlorobenzidine	2-Methylnaphthalene
Benzo(k)fluoranthene	2,4-Dichlorophenol	2-Methylphenol
bis(2-Chloroethoxy)methane	Diethylphthalate	4-Methylphenol
bis(2-Chloroethyl)ether	2,4-Dimethylphenol	Naphthalene
bis(2-Ethylhexyl)phthalate	Dimethyphthalate	2-Nitroaniline
4-Bromophenyl-phenylether	Di-n-butylphthalate	3-Nitroaniline
Butylbenzylphthalate	Di-n-octylphthalate	4-Nitroaniline
Carbazole	4,6-Dinitro-2-methylphenol	Nitrobenzene
4-Chloroaniline	2,4-Dinitrophenol	2-Nitrophenol
4-Chloro-3-methylphenol	2,4-Dinitrotoluene	4-Nitrophenol
2-Chloronaphthalene	2,6-Dinitrotoluene	N-Nitroso-di-n-propylamine
2-Chlorophenol	Fluoranthene	N-Nitroso-diphenylamine
4-Chlorophenyl-phenylether	Fluorene	2,2-oxybis(1-Chloropropane)
Pentachlorophenol	Pyrene	2,4,5-Trichlorobenzene
Phenanthrene	1,2,4-Trichlorobenzene	2,4,6-Trichlorobenzene
Phenol		

Table I.1 Soil Analyte List (Continued)		
Pesticides/PCB's		
Aroclor-1016	Delta-BHC	Endosulfan II
Aroclor-1221	Gamma-BHC	Endosulfan sulfate
Aroclor-1232	alpha-Chlordane	Endrin
Aroclor-1242	gamma-Chlordane	Endrin aldehyde
Aroclor-1248	4,4'-DDD	Endrin ketone
Aroclor-1254	4,4'-DDE	Heptachlor
Aroclor-1260	4,4'-DDT	Heptachlor epoxide
Aldrin	Dieldrin	Methoxychlor
Alpha-BHC	Endosulfan I	Toxaphene
Beta-BHC		
Inorganics		
Aluminum	Copper	Potassium
Antimony	Cyanide	Selenium
Arsenic	Iron	Silver
Barium	Lead	Sodium
Beryllium	Lithium	Thallium
Bismuth	Magnesium	Tin
Cadmium	Manganese	Vanadium
Calcium	Mercury	Zinc
Chromium	Molybdenum	Nitrate/Nitrite
Cobalt	Nickel	Explosives (USATHAMA,PETN)
Radionuclides		
Americium-241	Plutonium-238	Thorium-230
Bismuth-207	Plutonium-239/240	Thorium-232
Bismuth-210	Potassium-40	Uranium-234
Cesium-137	Radium-226	Uranium-235
Cobalt-60	Thorium-228	Uranium-238

1.2. SAMPLE NUMBERING SCHEME

The sample identification numbers were assigned by Mound to each location in the following format: XXX-AAA-######. For each location, the first three characters were SGC, identifying the sample as part of the soil gas confirmation study. The next three characters represented the area from which each sample was taken:

A03 = Area 3
A07 = Area 7
A13 = Area 13
A21 = Area 21
A22 = Area 22
SDB = Area SDB
AOJ = Area AOJ
NAC = Non-AOC areas (Area of Concern)
SAN = Sanitary area

The final six digits were a sequential number beginning with 000001. The samples related to this study begin with 000001 and end with 000102. Due to an error in surveying, samples 000099 and 000100 were taken from the wrong locations. The sites were resurveyed and the samples were taken again, renamed as 000101 and 000102. No other problems arose with the sample identification.

1.3 SURVEYING

Prior to this sampling event, surveying relocated each of the 100 sites based on coordinates from a previous soil gas sampling event. Surveyors from Barge, Waggoner, Sumner and Cannon, of Miamisburg, Ohio, completed the task, using a benchmark map of approximately 50 locations with state plane coordinates provided by EG&G. Each point was relocated with an accuracy of ±6 inches and identified with either a 3-foot stake with orange flagging tape and the sample identification number or a pin driven into the ground through orange flagging with the sample identification number written on the flagging. The surveyed sampling locations are shown on Figure 1.1.

1.4 UTILITIES CLEARANCE/VARIANCES

After surveying, all sites were checked for the presence of underground utilities by EG&G personnel. The requirement states that sample sites must be located five feet or more from utilities. Situations in which the 5-foot rule was not met were handled in one of three ways: 1) **relocations** - sample sites were placed 5 feet or more from utility markings and normal sampling procedures were followed; 2) **hand-digging** - the VOC sample soil was collected using the core sampler, which was driven only to the depth necessary to collect the VOC sample, and the remaining soil was collected using a hand auger; or 3) **variances to the 5-foot clearance requirement** - some sites were located near visible utilities, so after safe clearance was established, normal sampling procedures were followed. Alternatively, some locations had underground utilities at relitivley deeper depths. At these locations, normal sampling procedures were followed except that digging/coring was limited to two feet instead of the established three feet. No utilities were damaged during the sampling event.

Some locations had no utility interference but still could not be sampled to three feet due to "refusal"--an inability to drive the sampler deeper. This usually indicates that bedrock or large gravel has been reached. In such cases, multiple shallow cores were taken.

A complete list of sites with variances to the original soil gas sampling location or depth can be found in Table I.2.

1.5 SOIL SAMPLING METHODOLOGY

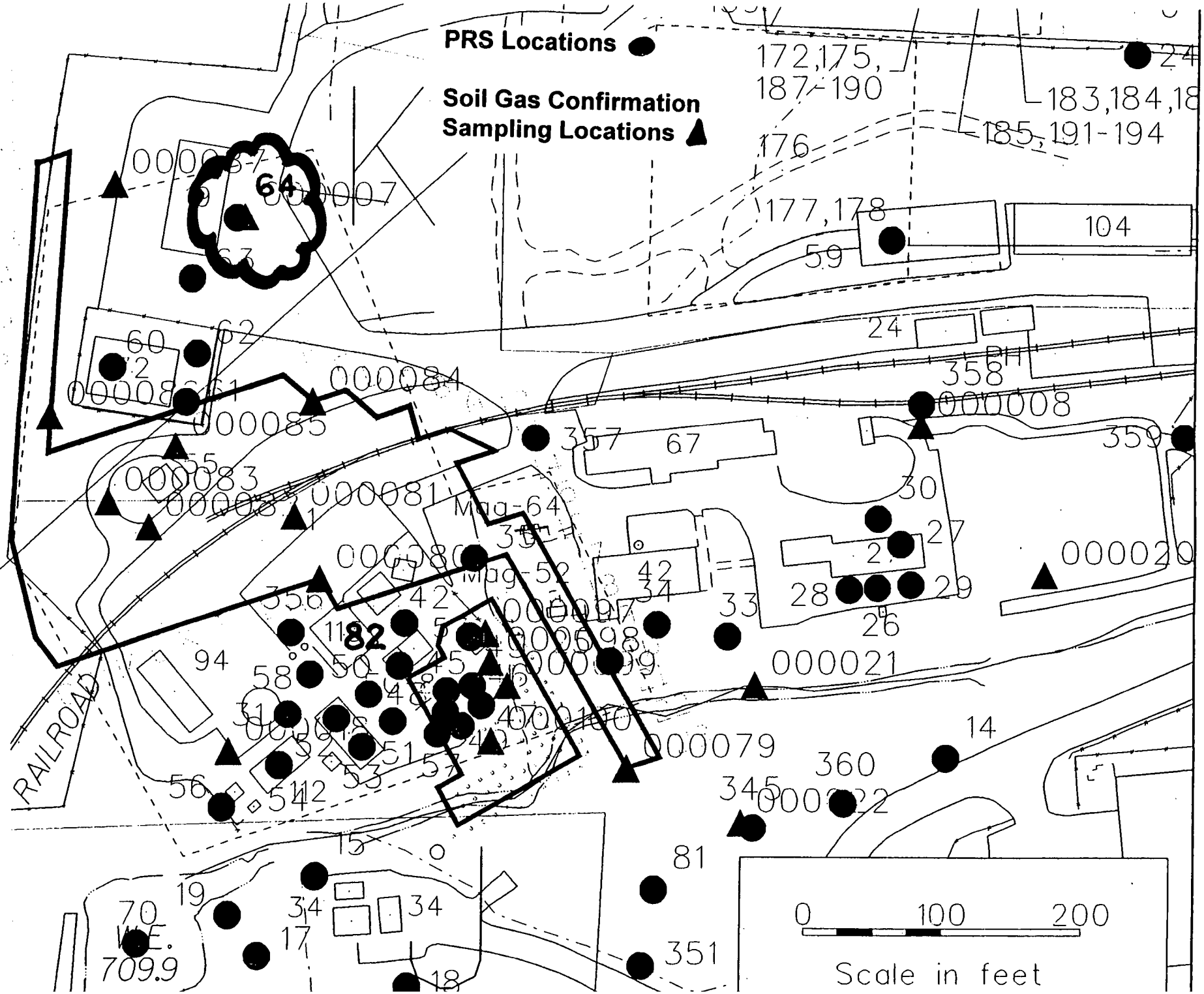
Soil was collected at each location using either a van-mounted Geoprobe® rig equipped with a core sampler, an electric hammer equipped with a core sampler, or a hand auger. The device chosen depended upon the particulars of the location. Acetate liners were used in the Geoprobe® core barrel and the hand-held core sampler. The liners were cut open with utility knives, using a new blade at each site.

The first six inches of the core, designated for radionuclide analysis, were removed using a clean, stainless steel scoop and placed in a clean stainless steel bowl to be homogenized. Soil was cut from between the 6-inch and 1-1/2 foot depth and placed directly into jars appropriate for volatile organic compound (VOC) analysis, leaving as little headspace as possible. The remaining soil was then placed into another clean stainless steel bowl. If necessary to obtain sufficient sample volume, another core was taken, and the above process was repeated. When enough soil was collected to fill all the sample jars, the contents of both bowls were individually homogenized and used to fill their respective containers. The jars were labeled prior to being filled. Each sample was then secured with a custody seal, sealed in a plastic bag and stored in a refrigerator in Building 19. Radiological samples were delivered to the Mound Environmental Laboratory for screening. Several duplicate radiological samples were collected and set aside for later analysis by the Mound wet chemistry laboratory. After screening clearance was obtained from the Mound Environmental Laboratory, the samples were sealed in coolers and shipped to off-site contract laboratories for analysis. The contract laboratory for radionuclide analysis was Quanterra Environmental Services in Richland, Washington. All other analyses were completed by Roy F. Weston, Incorporated Laboratory in Lionville, Pennsylvania.

acc
nple

Table I.2. Variance From 3-Foot Sampling Depth Specification

Location	Description of Variance
SGC-NAC-000001	Core sampler hit refusal at 2 feet.
SGC-NAC-000002	Relocated due to utilities.
SGC-NAC-000003	Core sampler hit refusal at 2 feet.
SGC-NAC-000004	Core sampler hit refusal at 18 inches.
SGC-NAC-000005	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-NAC-000006	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-NAC-000007	Core sampler hit refusal at 18 inches.
SGC-NAC-000008	Drilled to 2 feet due to utilities.
SGC-NAC-000010	Drilled to 1 foot; hand-augered rest due to utilities; flag against building, so sample taken 6 feet from flag.
SGC-NAC-000012	Drilled to 2 feet due to utilities.
SGC-SAN-000018	Core sampler hit refusal at 2 feet; relocated from inside clarifier.
SGC-NAC-000029	Core sampler hit refusal at 18 inches.
SGC-A61-000043	Sampled 1 foot from flag.
SGC-A61-000047	Drilled to 2 feet due to utilities.
SGC-A61-000048	Drilled to 2 feet due to utilities.
SGC-A61-000049	Relocated due to utilities.
SGC-A61-000051	Core sampler hit refusal at 18 inches.
SGC-A61-000052	Relocated due to utilities; core sampler hit refusal at 18 inches.
SGC-A61-000053	Core sampler hit refusal at 2 feet.
SGC-A13-000056	Core sampler hit refusal at 18 inches
SGC-A13-000058	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-A13-000060	Core sampler hit refusal at 1 foot.
SGC-AOJ-000064	Core sampler hit refusal at 2 - 3 inches.
SGC-AOJ-000066	Core sampler hit refusal at 4 inches.
SGC-AOJ-000067	Core sampler hit refusal at 6 inches.
SGC-AOJ-000069	Core sampler hit refusal at 2 feet.
SGC-A03-000080	Core sampler hit refusal at 20 inches
SGC-A03-000081	Drilled to 2 feet due to utilities.
SGC-A03-000082	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-A03-000083	Sampled 25 feet from original location due to storm sewer; core sampler hit refusal at 18 inches.
SGC-A03-000087	Core sampler hit refusal at 2 feet.
SGC-A21-000088	Core sampler hit refusal at 18 inches.
SGC-A21-000090	Core sampler hit refusal at 20 inches.
SGC-SDB-000097	Relocated due to utilities.
SGC-SDB-000098	Relocated from inside a building.
SGC-SDB-000101	Relocation of SGC-SDB-000099; first location surveyed incorrectly.
SGC-SDB-000102	Relocation of SGC-SDB-000100; first location surveyed incorrectly.


PRS Locations
Soil Gas Confirmation Sampling Locations
172,175, 187-190
183,184,18
185, 191-194
176
177,178
104
59
24
358
000008
359
67
357
30
27
000020
28
29
26
33
34
42
000021
14
360
000079
345
000022
81
351
0 100 200
Scale in feet
RAILROAD
64
82
000084
000085
000083
000081
Mag-64
Mag-52
000080
000098
000099
000097
000079
94
58
56
15
19
70
709.9
17
34
18
63
60
62
55
1

The following tables contain the Soil Gas Confirmation Sampling results. Sampling was performed for the following categories of contaminants:

Volatiles
Semivolatiles
PCBs/pesticides
Metals
Radionuclides
Explosives

If no results are given for the contaminant categories listed above, then no detects were found for that category of contaminants.

Table A.1. Soil Gas Confirmation Detected Volatile Organic Compounds

ANALYTE	SGC NAC 000002	SGC NAC 000003	SGC NAC 000004	SGC NAC 000005	SGC NAC 000006	SGC NAC 000007	Background	10^{-6} Construction Worker Guidelines
VOLATILES (µg/Kg)								
Acetone	36						NA	105000000
1,2-Dichloroethene (total)							NA	21500000
2-Butanone							NA	46500000
Benzene	1						NA	8900
Carbon Disulfide							NA	1400000
Chloroform			67				NA	NA
Chloromethane							NA	NA
Ethylbenzene							NA	480
Methylene Chloride				7	8		NA	NA
Tetrachloroethene							NA	10500000
Toluene	1 J	1 J					NA	1250000
Trichloroethene						7	NA	41000
Xylene (total)							NA	2150000000

Table A.4. Soil Gas Confirmation Detected TAL Inorganics (cont.)

ANALYTE	SGC NAC 000007		SGC NAC 000008		SGC NAC 000009		SGC NAC 000010		SGC NAC 000011		SGC NAC 000012		Background	10^{-6} Construction Worker Guidelines
INORGANICS (mg/kg)														
Aluminum	10200		2820		18700		7300		10[illegible]		13100		19000	NA
Antimony			0.27	B	0.91	B	[illegible]	B	1.2	[illegible]			NA	425
Arsenic	1.9	B	3.2		11.1		7.2		2.2	B	1.9	BJ	8.6	320
Barium	26.2	B	23.2	[illegible]	163		64.7		13.5	B	78[illegible]		180	75000
Beryllium	0.28				[illegible].9	B	0.34		[illegible]	B	0.44		1.3	0.7
Bismuth					0.85	B			0.99	B			NA	NA
Cadmium	0.33	B	0.22	B	6		0.62	B	5.2		6.0		2.1	1050
Calcium	83900		113000		5940		11500		90800		12[illegible]00	J	310000	NA
Chromium	14.3		5.7		20.3		1[illegible]		11.9		17.3		20	1050000
Cobalt	11	B	3.3	B	13		7.9	B	13.7		12.7	J	19	NA
Copper	16.2		13.9		19.2		17.4		16.6		21.3	J	26	NA
Cyanide													ND	21400
Iron	23000		7660		[illegible]9400		17300		25600		27900		35000	NA
Lead	7.2		5.9		22.[illegible]		16.5		5.7		9.3	J	48	NA
Lithium	3.2	B	8.2	B	14.7	[illegible]	9.2	B	27.3		[illegible]5.3		26	NA
Magnesium	21600		47900		4500		16700		12300		1990[illegible]	J	40000	NA
Manganese	493		256		728		6[illegible]		908		658		1400	135000
Mercury													NC	320
Molybdenum	0.63	B	1.4[illegible]	B	1.8	B	2.3	B	0.58	B	1.3	B	27	NA
Nickel	22.6		8.1	[illegible]	24.5		16.5		2[illegible]6		26.4		32	21500
Potassium	1590		463	B	[illegible]20		794	B	2210	B	1630		1900	NA
Selenium									0.31	B			NA	NA
Silver													1700	5500000
Sodium	246	B	341	B	1010	B	[illegible]2	B	288	B	2490[illegible]	J	240	NA
Thallium													460	NA
Tin			4.5	[illegible]	1.5	B					1.6	B	20	NA
Vanadium	14.2		7.4		[illegible]2.7		19.2		1[illegible]		22.4		25	7500
Zinc	53.8		36.6		71.[illegible]		299		59.9		68.5		140	320000

Table A.5. Soil Gas Confirmation Detected Nitrate-Nitrite

ANALYTE	SGC NAC 000001	SGC NAC 000002	SGC NAC 000003	SGC NAC 000004	SGC NAC 000005	SGC NAC 000006	Background	10^{-6} Construction Worker Guidelines
GENERAL ANALYTES								
% Solids (%)	83.9	83.8	88.5	83.3	78.[illegible]	75.0	NA	NA
Nitrate/Nitrite (MG-N/KG)	2.0	1.8	1.2	2.1	7.2	4.8	26	NA

ANALYTE	SGC NAC 000007	SGC NAC 000008	SGC NAC 000009	SGC NAC 000010	SGC NAC 000011	SGC NAC 000012	Background	10^{-6} Construction Worker Guidelines
GENERAL ANALYTES								
% Solids (%)	83.9	95.0	78.9	83.9	90.1	84.7	NA	NA
Nitrate/Nitrite (MG-N/KG)	1.6	26.5	2.2	5.[illegible]	5.3	1.8	26	NA

ANALYTE	SGC NAC 000013	SGC NAC 000014	SGC NAC 000015	SGC NAC 000016	SGC NAC 000017	SGC NAC 000018	Background	10^{-6} Construction Worker Guidelines
GENERAL ANALYTES								
% Solids (%)	81.7	80.[illegible]	74.0	85.[illegible]	72.8	84.2	NA	NA
Nitrate/Nitrite (MG-N/KG)	2.[illegible]	4.9	3.0	2.4	6.4	13.[illegible]	26	NA

ANALYTE	SGC NAC 000019	SGC NAC 000020	SGC NAC 000021	SGC NAC 000022	SGC NAC 000023	SGC NAC 000024	Background	10^{-6} Construction Worker Guidelines
GENERAL ANALYTES								
% Solids (%)	85.3	87.6	77.4	78.3	77.5	89.5	NA	NA
Nitrate/Nitrite (MG-N/KG)	6.5	2.1	6.1	2.2	1.6	2.2	26	NA

Table A.6. Soil Gas Confirmation Detected Radionuclides

ANALYTE	SGC NAC 000001	SGC NAC 000002	SGC NAC 000003	SGC NAC 000004	SGC NAC 000005	SGC NAC 000006	SGC NAC 000007	Background	10^{-6} Construction Worker Guidelines
RADIONUCLIDES (pCi/g)									
Americium-241								ND	4.95
Bismuth-207								ND	0.175
Bismuth-210								ND	NA
Cesium-137						0.86		0.42	0.46
Cobalt-60								NC	0.1
Plutonium-238	1.42	0.0690	0.033	0.08	0.543	4.32	0.537	0.13	5.5
Plutonium-239/240			0.025					0.18	5.5
Potassium-40	21.7	8.95	6.53	27.4	15.1	14	10.8	37	NA
Radium-226	1.03	0.47	0.508	1.16	22	0.870	0.537	2	0.14
Thorium-228	1.52	0.277	0.370	1.4	1.05	1.06	0.431	1.5	0.85
Thorium-230	0.14	0.374	0.621	0.980	1.19	1.18	0.582	1.9	44
Thorium-232	1.30	0.184	0.15	1.17	0.950	1.18	0.328	1.4	50
Uranium-234	2.19	0.401	0.419	0.934	0.874	0.61	0.551	1.1	37.5
Uranium-235	0.0974		0.0400	0.0349	0.0328			0.11	3.35
Uranium-238	2.35	0.392	0.512	0.918	0.913	0.815	0.574	1.2	11

MOUND

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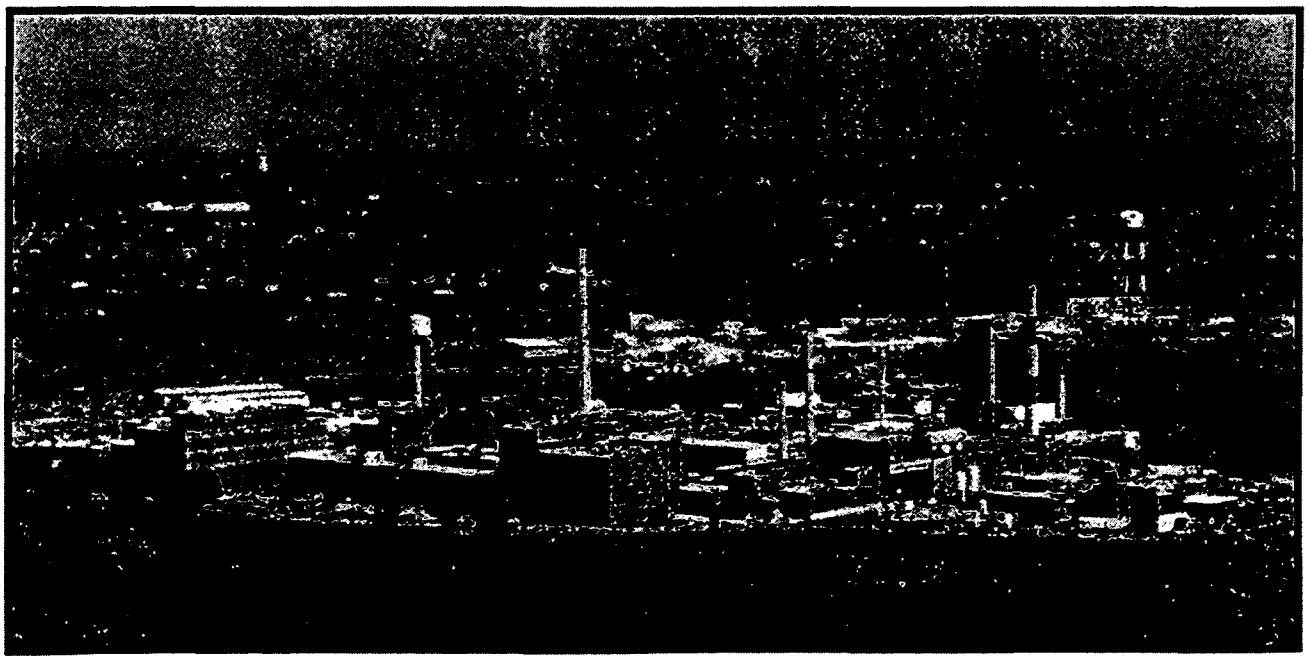
Miamisburg Closure Project
Potential Release Site Package

PRS 417

Final
June 2003



The Mound Core Team
P.O. Box 66
Miamisburg, Ohio 45343-0066

June 2003

Mr. Daniel Bird, AICP
Planning Manager
Miamisburg Mound Community Improvement Corporation
720 Mound Road
COS Bldg. 4221
Miamisburg, Ohio 45342-6714

Dear Mr. Bird:

The Core Team, consisting of the U.S. Department of Energy Closure Project (DOE-MCP), U.S. Environmental Protection Agency (USEPA), and the Ohio Environmental Protection Agency (OEPA), appreciates your comments on the PRS 417 Public Review Draft Package. Attached are our responses.

Should the response to comments require additional detail, please contact Paul Lucas at (937) 847-8350 extension 314 and we will gladly arrange a meeting or telephone conference.

Sincerely,

DOE/MCP:	Paul Lucas, Remedial Project Manager	6/18/03 date
USEPA:	David P. Seely, Remedial Project Manager	6/24/03 date
OEPA:	Brian K. Nickel, Project Manager	6/18/03 date

Response to Public Comments

from MMCIC
on PRS 417 Public Review Draft Package
March 2003

Comment 1. From our review of the PRS 417 Public Review Draft, MMCIC understands that this PRS was binned for further review in 1998 based on leaching potential of historic soil sample results of TCE (trichloroethylene). We understand that subsequent sampling was performed and confirmed that the levels of TCE were below the more stringent of the Risk-Based Guideline Values or the Hazard Index values. Although four downgradient wells will continue to be monitored for TCE, MMCIC understands that PRS 417 does not appear to be a source of the TCE and further investigation of this PRS is not required.

Response 1. Thank you for your review and comment. Your interpretation of the information presented in the PRS 417 Package, Public Review Draft dated March 2003 is accurate.

Environmental Restoration Program

MIAMISBURG CLOSURE PROJECT
POTENTIAL RELEASE SITE PACKAGE
Notice of Public Review Period

The following Potential Release Site (PRS) package is available for public review in the CERCLA Public Reading Room, 305 E. Central Ave., Miamisburg, Ohio. Public comment on this document will be accepted 02 April 2003 through 02 May 2003.

PRS 417: Soil Contamination, High Soil Gas near Well 0312

Questions can be referred to Paul Lucas at (937) 865-4578

PRS 417 Package Tracking Sheet

REVISION	DESCRIPTION	DATE
Working Draft (to DOE)	Binned FA on 6 August 1998.	
Draft (to Core Team)		
Draft Proposed Final	Addendum 1 submitted to CT. No USEPA comments. OEPA comments included adding Table 1 with Maximum VOC results. PRS binned NFA on 19 March 2003. Added Addendum 1 to original package and submitted as public review draft.	**January 2003**
Public Review Draft	Public review period: 02 April to 02 May 2003.	**March 2003**
Final	There were no public comments that required changes to the document.	**June 2003**

ADDENDUM 1

SUPPORTING NFA RECOMMENDATION

MOUND

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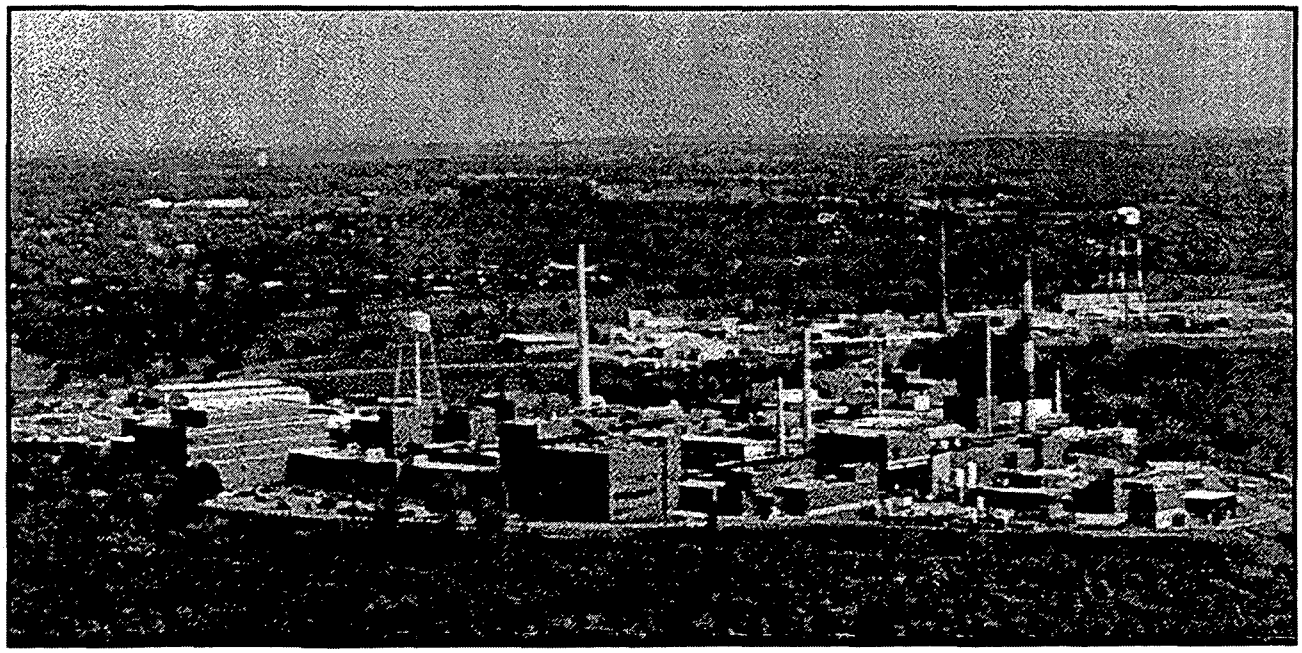
Potential Release Site Package

PRS 417

Addendum 1

Final
June 2003



PRS HISTORY:

Potential Release Site (PRS) 417 is located on the western boundary of the site as shown on Figure 1 and was binned Further Assessment (FA) by the Core Team on 6 August 1998. PRS 417 was identified based on the leaching potential of historic soil sample results of TCE (trichloroethylene) at depths to 15-20 feet below ground surface.

FURTHER ASSESSMENT ACTIVITY:

PRS 417 sampling was grouped with PRSs 41 and 64 due to their proximity to each other. This addendum applies to PRS 417 only. The potential contaminant of concern (COC) was TCE via VOC (volatile organic compound) analysis. TCE has been detected in four groundwater monitoring wells downgradient from PRS 417 (Figure 2). TCE detections have been trending downward as shown on Figures (3-6) and results for all four wells are currently below the maximum contamination level (MCL) for TCE.

Further Assessment sampling was completed in November 2002 per the Sampling and Analysis Plan (**SAP**)[1] approved by the Core Team.

All 55 soil samples, six duplicate samples, and one groundwater sample were analyzed for VOCs. The FA sample locations are presented in Figure 7. The FA **Data Report**[2] presents a full account of soil and groundwater sampling activities and sample results.

Further Assessment results confirmed that TCE, and all other VOCs analyzed, are significantly below the more stringent of the 10^{-6} Risk-Based Guideline Values (RBGVs) or Hazard Index of one values.

Detection limits for all analytes were significantly below the more restrictive of the 10^{-6} RBGVs or Hazard Index of one values. The only detections were for TCE, 1,2-dichloroethene, and methylene chloride. TCE and 1,2-dichloroethene detections (Table 1) were found to not have the potential to leach to groundwater at unacceptable levels. Methylene chloride detections were not assessed for leachability because the analyte was found in all of the lab blanks analyzed.

Table 1: VOC Detections (ug/kg)

Analyte	Maximum Result	Soil Screening Level	Screening Level*
TCE	180	180	5,090
1,2-dichloroethene	130	730	2,130,000

* more restrictive of 10^{-6} RBGV or Hazard Index of one value

FIGURES:

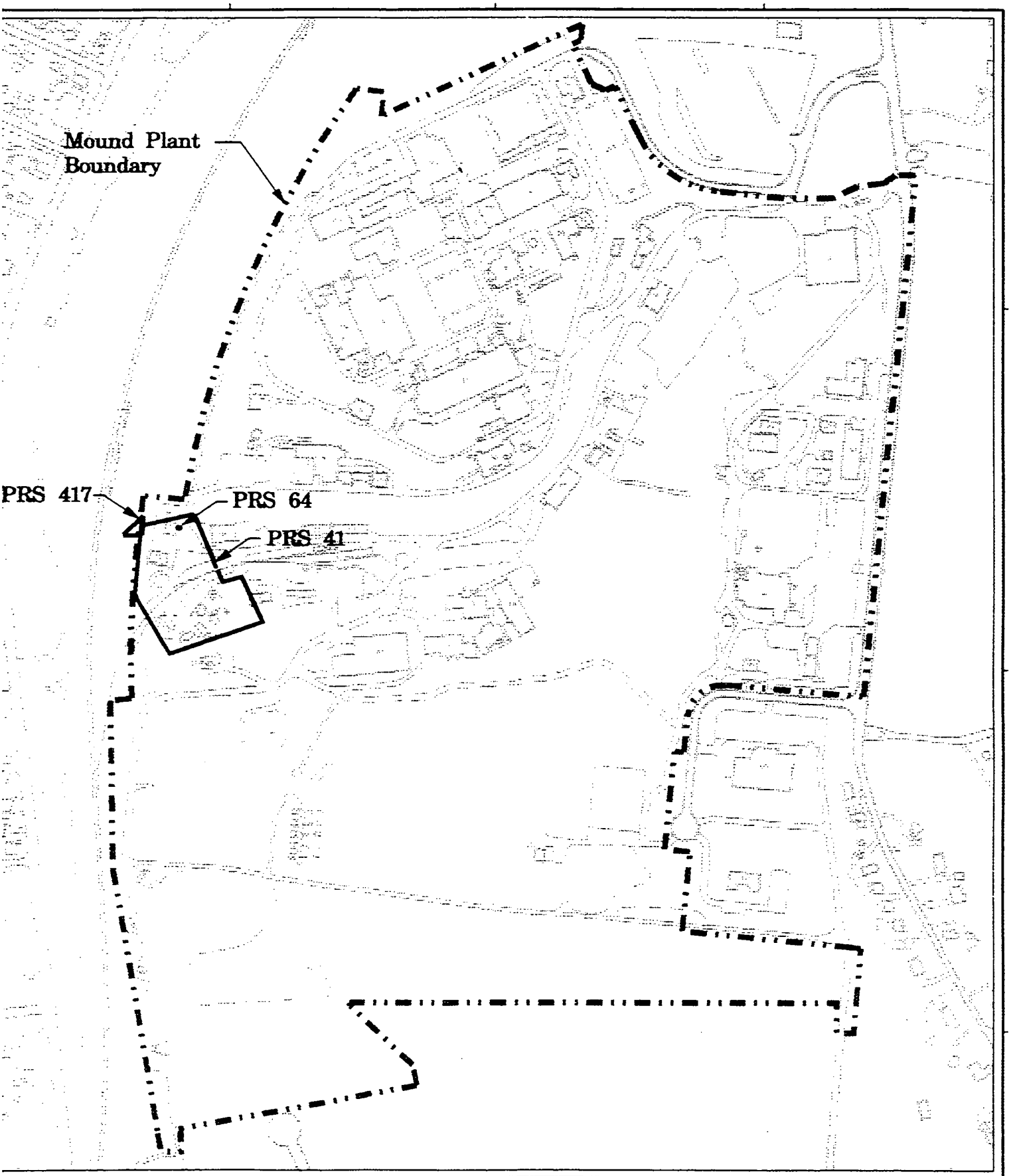
Figure 1: Location of PRS 41/64/417
Figure 2: Location of Wells
Figures 3-6: TCE Trend Results
Figure 7: PRS 417 Sample Locations

REFERENCES:

1) PRS 41/64/417 Sampling and Analysis Plan, Final, November 2002
2) PRS 41/64/417 Data Report, Rev. 0, December 2002

PREPARED BY:

Gary Miller, CH2MHill, ER Technical Staff
Karen M. Arthur, CH2MHill, ER QA



Legend

Structures
Paved roadway
Unpaved roadway
Mound Plant boundary
Railroad

0 100 200 400 600 800 1000
Scale In Feet

DATE	REVISION	BY	CHKR	ENG	LPMEE	APVD	#
06/24/02	*	SSP					

MOUND

Environmental Restoration Geographic Information System

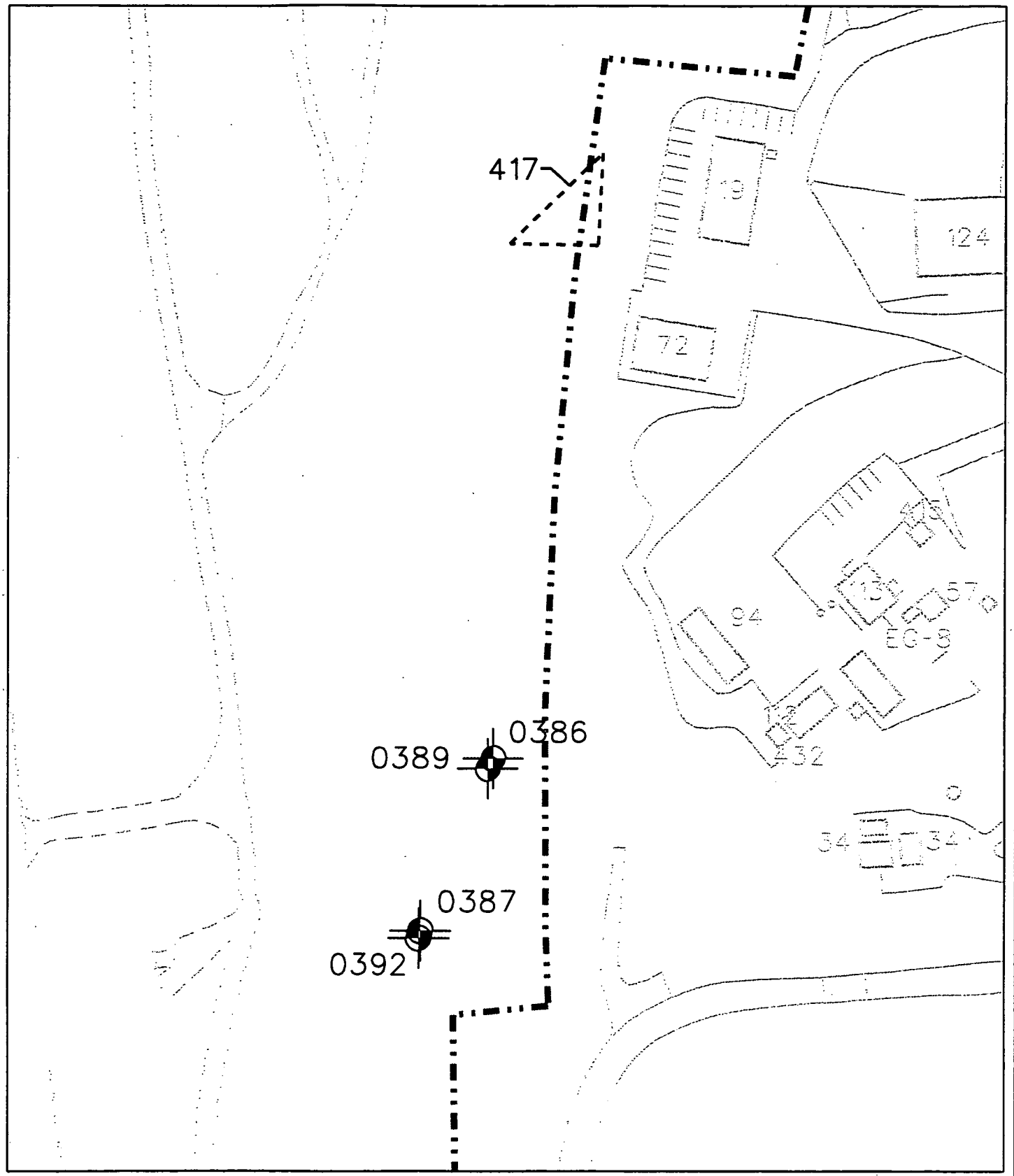
SHEET	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
ISSUE																					
SHEET	1	2	3	4	5	6															
ISSUE																					

PART CLASSIFICATION

Figure 1: Location of PRS 41/64/417

DRAWING CLASSIFICATION: UNCLASSIFIED
SIZE
DRAWING NUMBER: gen_site_plan.dgn
JOB NUMBER
DWG TYPE: STE
PROJ: ER-GIS
CAGE:
SCALE
SHEET 1 OF
STATUS: MD-REL
ORIGIN: MSTATION / .1

3 of 10



0 20 40 60 80 100
Scale in Feet

MOUND
Environmental Restoration Geographic Information System

Figure 2: Wells Down Gradient of PRS 417

UNCLASSIFIED

02/27/03		SSF							
DATE	REVISION	BY	CHKR	DIC	UPREC	APVD			

DWG TYPE STE PRNG ER-GIS CODE SCALE SHEET 1 OF 1
STATUS MD-REL-02/27/03 ORIGIN MSTATION / J

4 of 10

Figure 3: TCE and PCE in Monitoring Well 0386

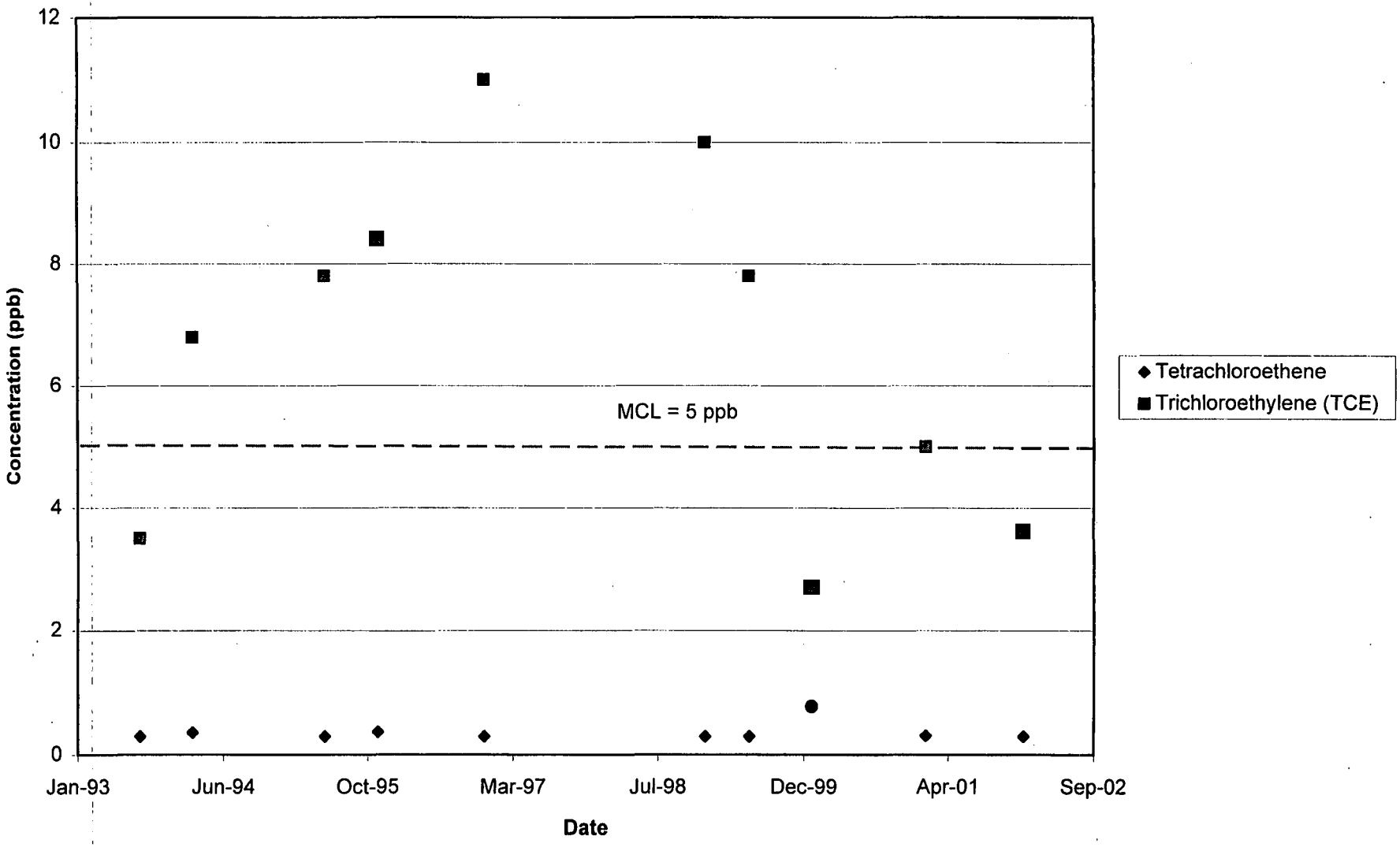


Figure 4: TCE and PCE in Monitoring Well 0387

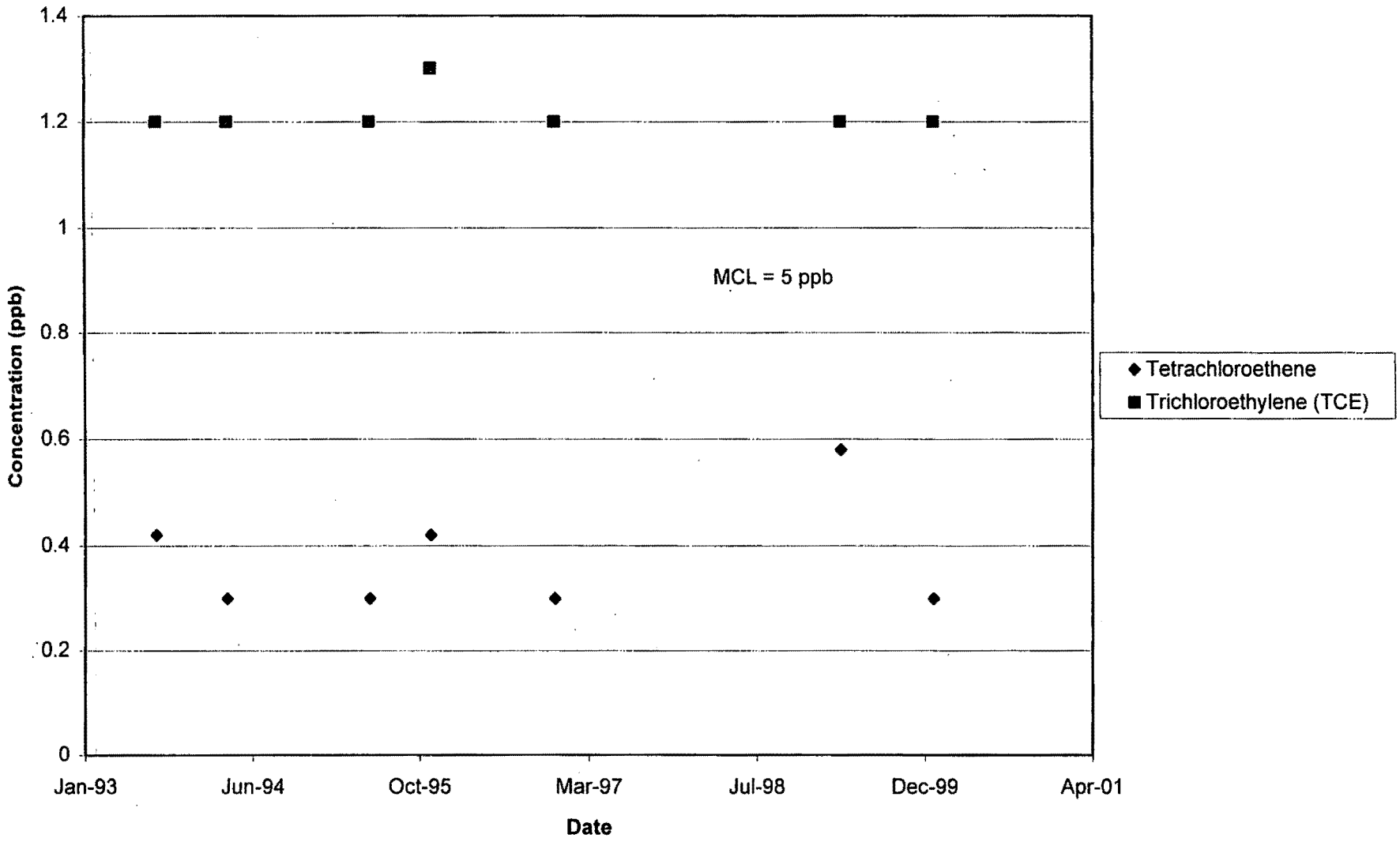


Figure 5: TCE and PCE in Monitoring Well 0389

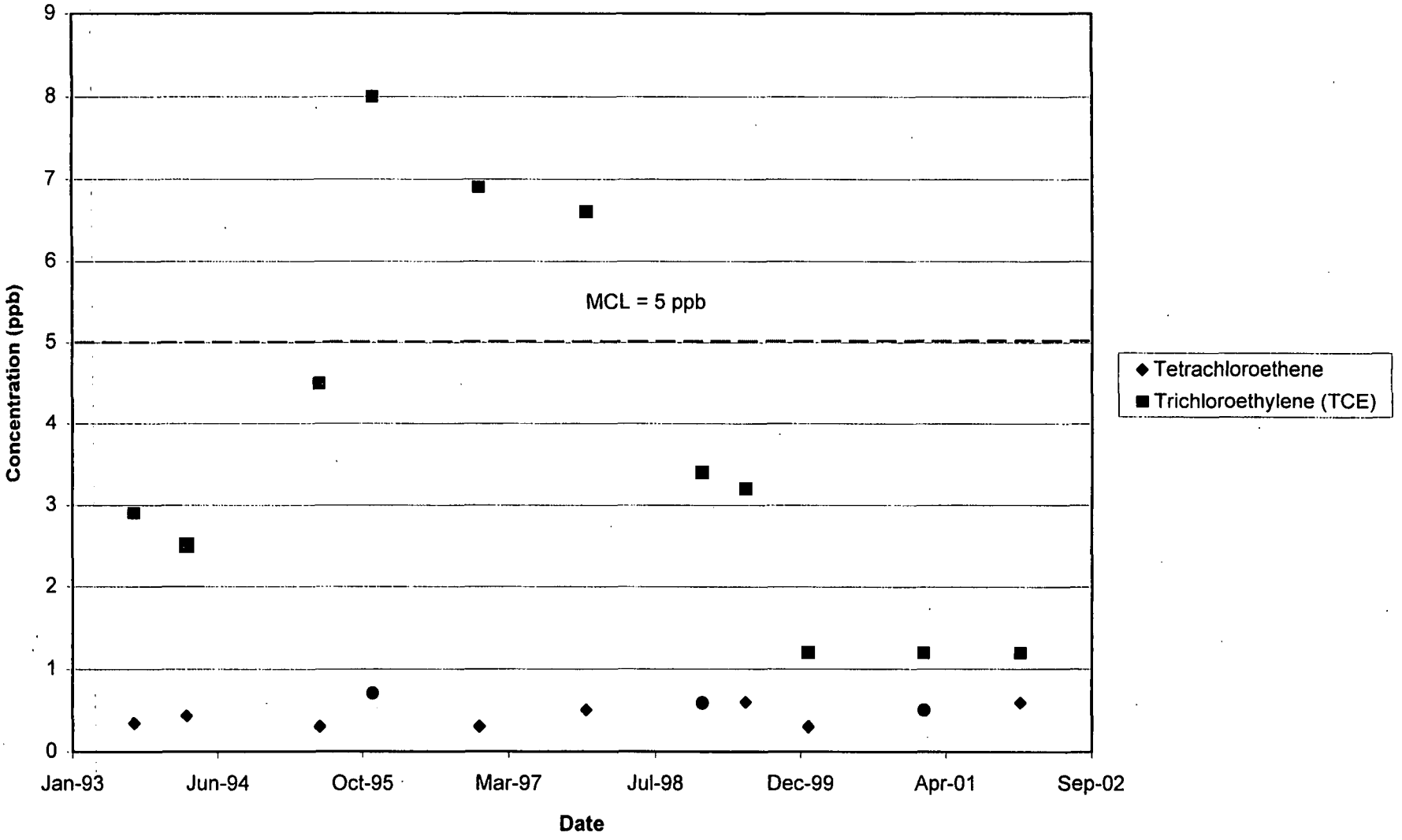
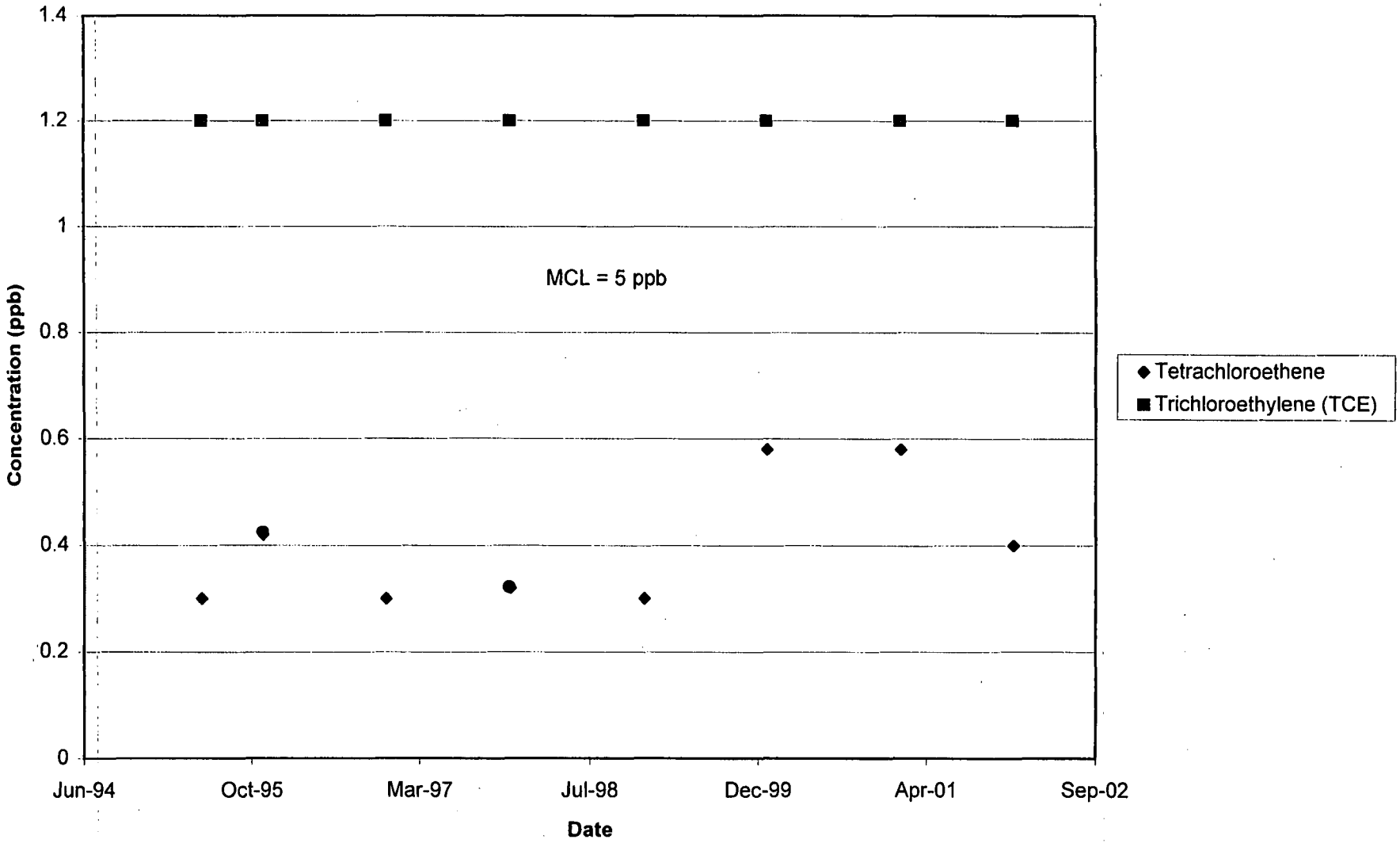
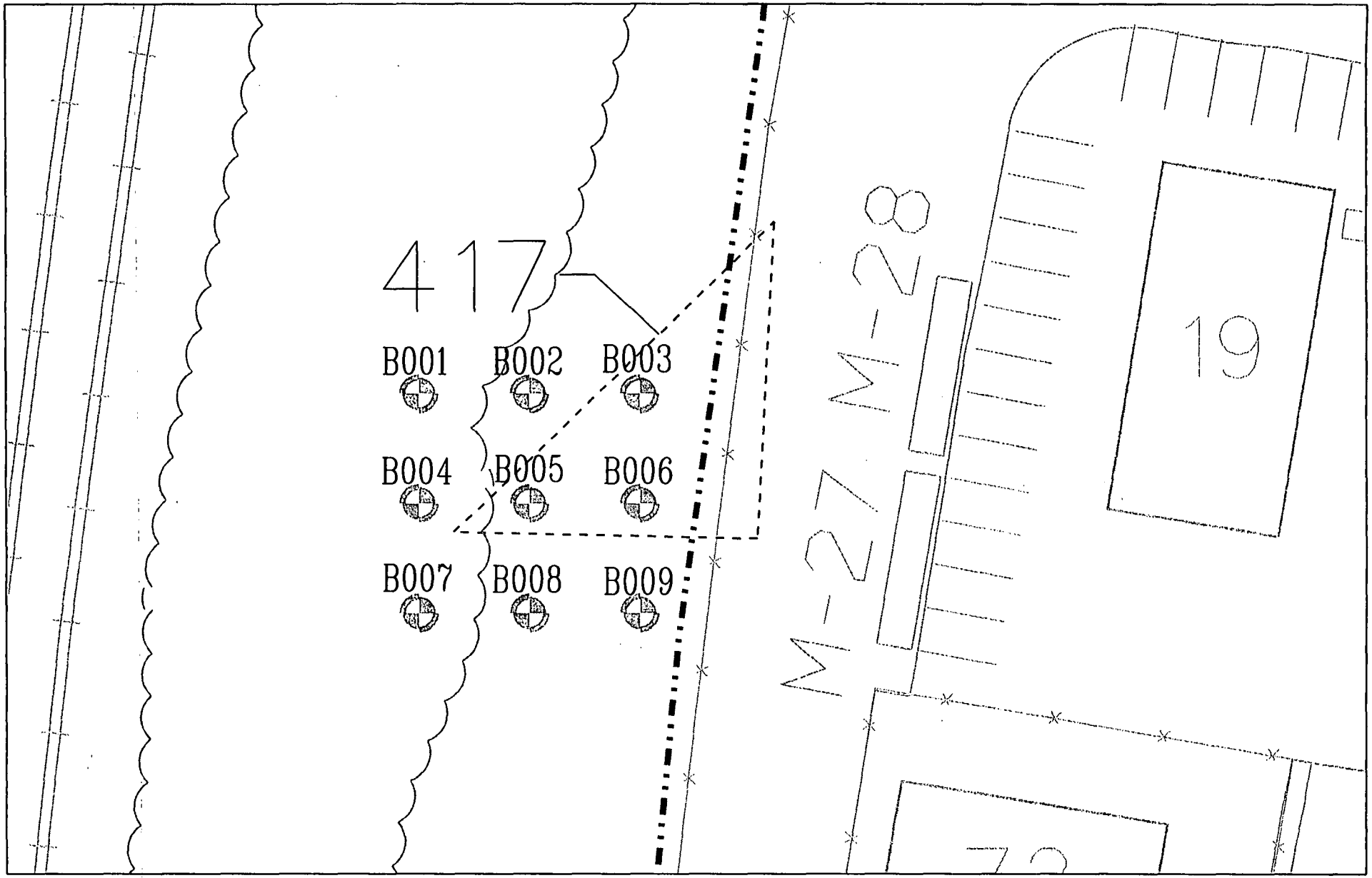


Figure 6: TCE and PCE in Monitoring Well 0392





PRS 417 (VOC) @ 9x6 intervals

20 10 0 20 40FT
GRAPHIC SCALE

MOUND
Environmental Restoration Geographic Information System

SHEET	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
ISSUE																					
SHEET	1	2	3	4	5	6															
ISSUE	*																				

PART CLASSIFICATION

Figure 7 PRS 417
Sample Locations

DRAWING CLASSIFICATION: UNCLASSIFIED
SIZE
DRAWING NUMBER: fig2_prs417.dgn
JOB NUMBER: *
DWG TYPE: STE
PRMG: ER-GIS
CADEC
SCALE: *
SHEET 1 OF *
STATUS: MD-REL-01/15/03
ORIGIN: MSTATION / J

ISS	DATE	REVISION	BY	CHKR	ENG	LPMEC	APVD	M
	01/15/03		SSP					

9 of 10

MIAMISBURG CLOSURE PROJECT
PRS 417

RECOMMENDATION:

Potential Release Site (PRS) 417 is located on the western boundary of the site (Figure 1) and was binned Further Assessment by the Core Team on 6 August 1998. PRS 417 was identified based on the leaching potential of historic soil sample results of TCE (trichloroethylene) at depths to 15-20 feet below ground surface. Although not apparently connected to PRS 417, ongoing monitoring for TCE at four downgradient wells will continue, to confirm that levels of TCE remain below the MCL.

Further Assessment was performed and confirmed that the levels of TCE, and all other VOCs (volatile organic compounds) analyzed, are below the more stringent of the 10^{-6} Risk-Based Guideline Values (RBGV) or Hazard Index of one values.

Further, the only results above detection limits were for TCE, 1,2-dichloroethene, and methylene chloride. TCE and 1,2-dichloroethene detections were found to not have the potential to leach to groundwater at unacceptable levels. Methylene chloride detections were not assessed for leachability because the analyte was found in all of the lab blanks analyzed.

Therefore, the Core Team recommends **No Further Assessment** for PRS 417.

A PRS Package with an NFA recommendation signed by the Core Team will be placed in the Public Reading Room for a 30-day review period. Upon closure of the public review comments, if any, the PRS Package will be issued as a final document and made available in the Public Reading Room.

CONCURRENCE:

DOE/MCP: _____ 3/19/03
Robert S. Rothman, Remedial Project Manager (date)

USEPA: _____ 3/26/03
David P. Seely, Remedial Project Manager (date)

OEPA: _____ 3/19/03
Brian K. Nickel, Project Manager (date)

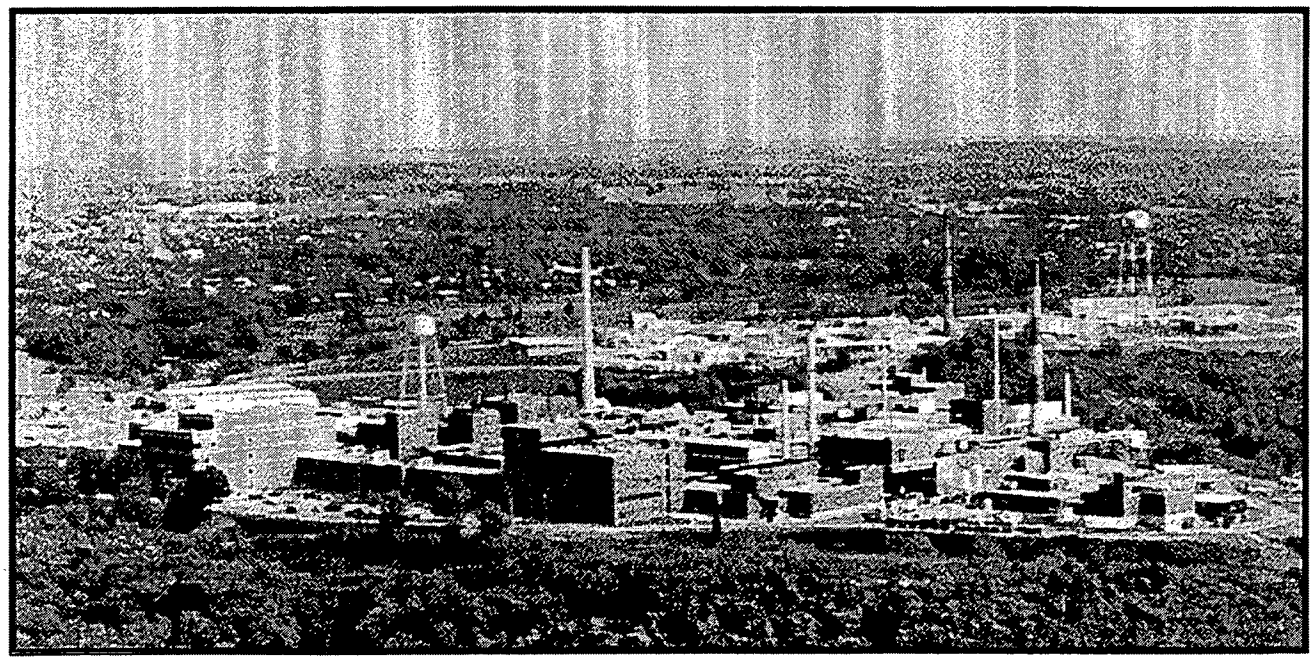
ORIGINAL DOCUMENT

SUPPORTING FA RECOMMENDATION

Environmental
Restoration
Program

Miamisburg Closure Project
Potential Release Site Package

PRS 417

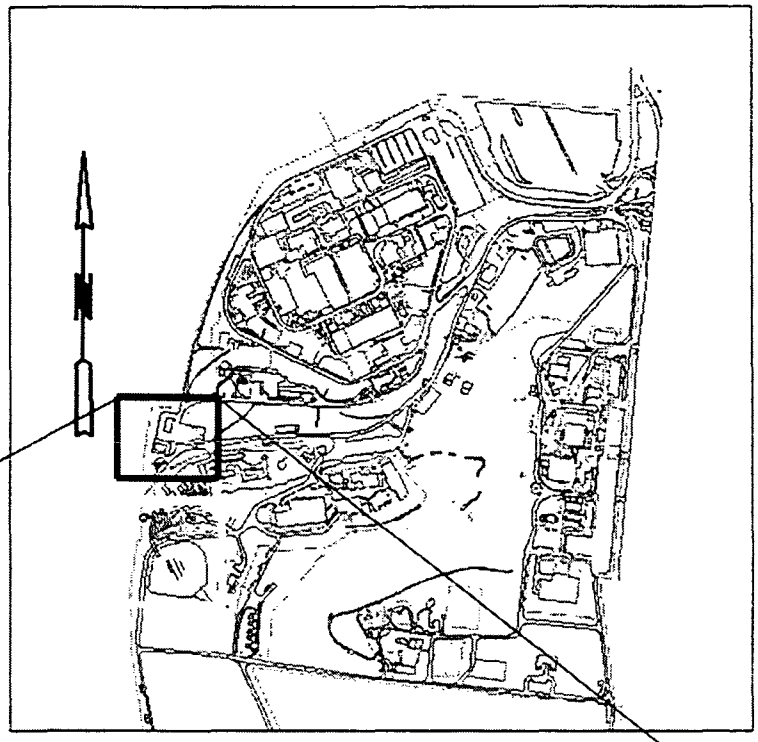


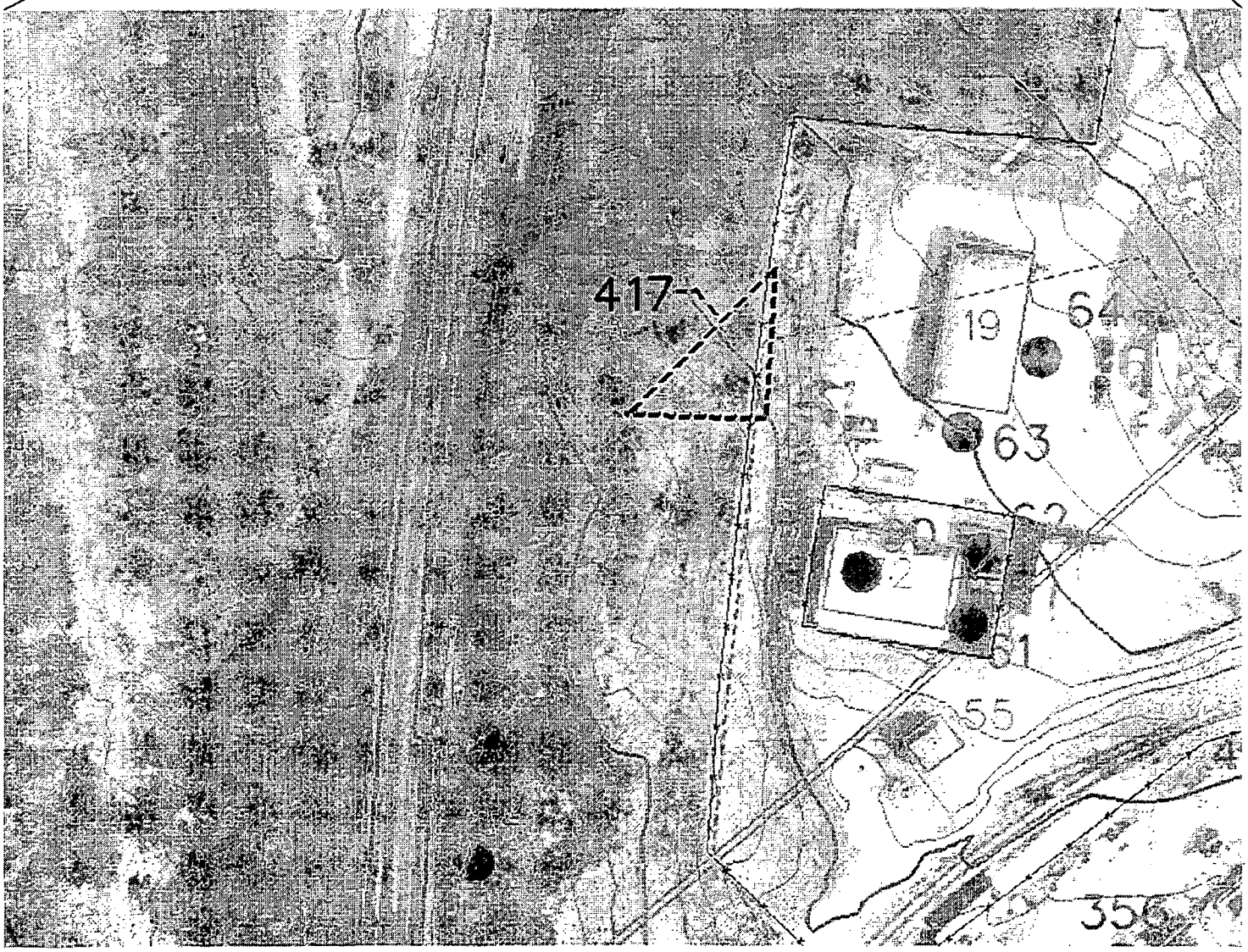
Mound Plant

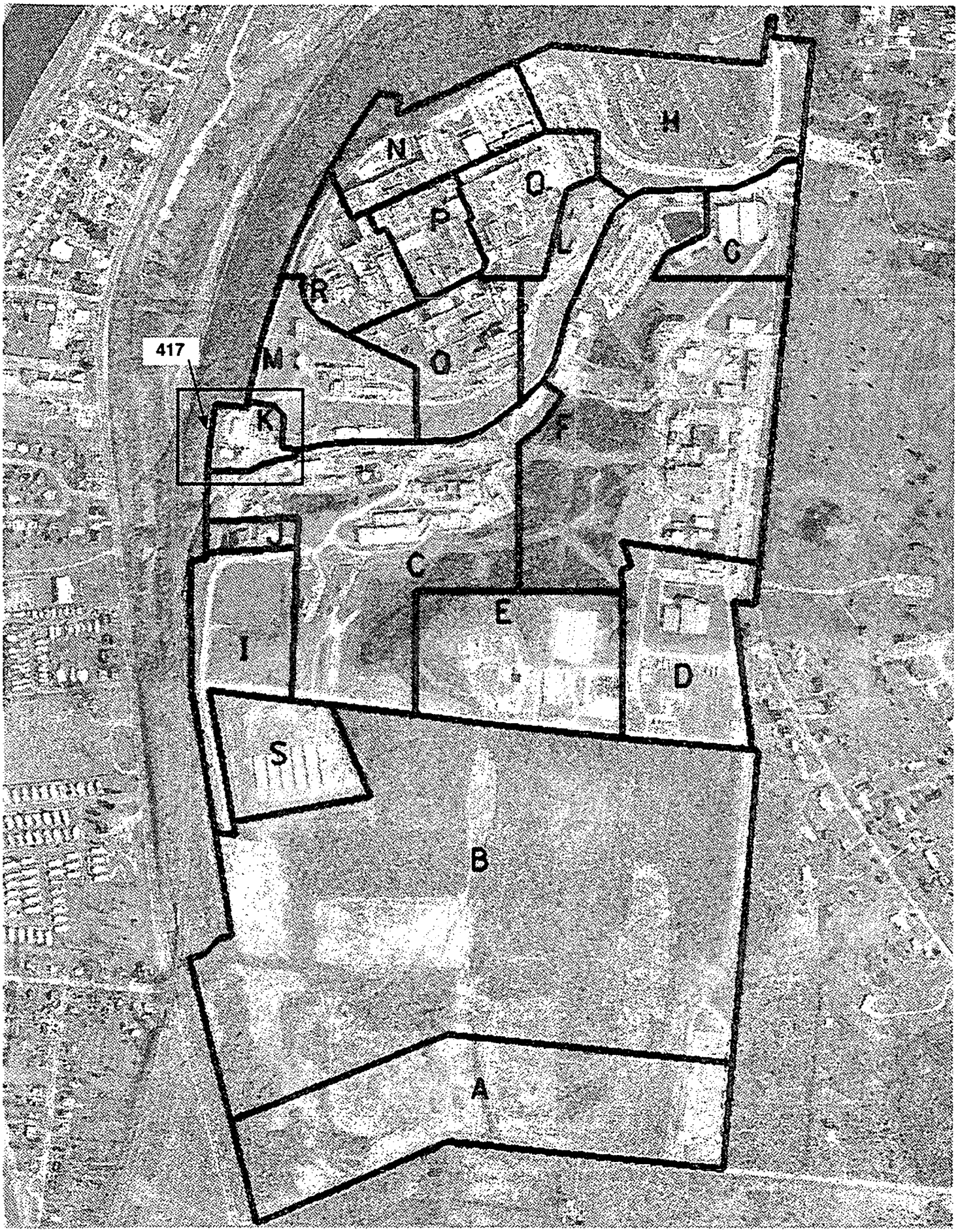
PRS 417

Soil Contamination – High Soil Gas Near Well 0312

On the map below:
- Building number and location shown in tan
- PRS number and location shown in black
- Fencing shown in red
- Elevation contours shown in brown



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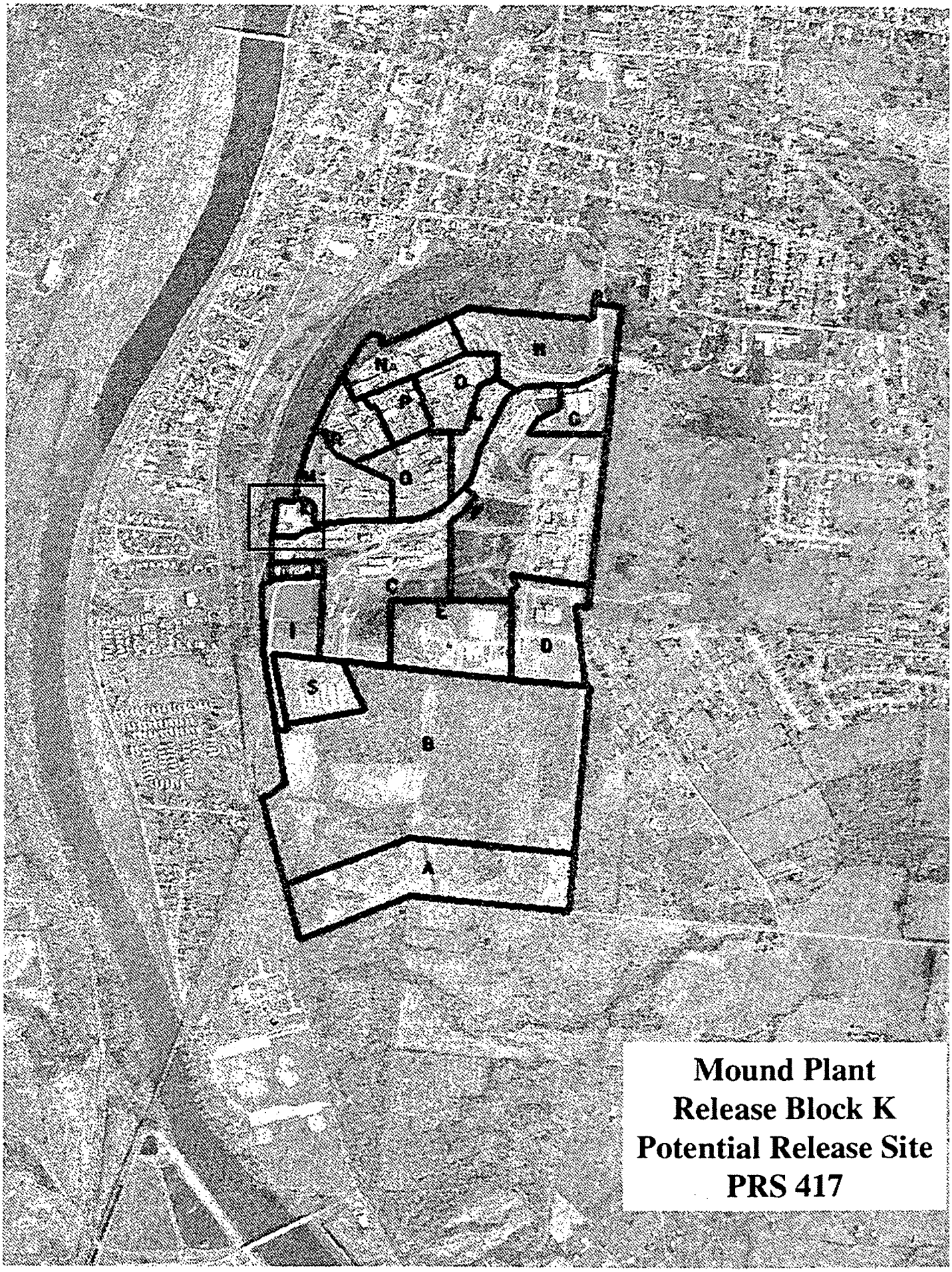

Mound Plant
Release Block K
Potential Release Site
PRS 417

PRS 417

PRS HISTORY:

PRS 417 is identified as a localized region of Volatile Organic Compound (VOC) contaminated soils located just west of Building 19. This PRS was identified as a result of a Limited Field Investigation study conducted in the summer of 1997[1].

CONTAMINATION:

Several Soil Gas Surveys have been conducted at the Mound Plant for the purpose of site characterization.

In 1997, a very large scale reconnaissance survey utilizing a geoprobe identified very localized elevated concentrations of TCE in the soil gas just southwest of Building 19. Field results indicated TCE concentrations in excess of 300 parts per billion (ppb) volume/volume (v/v), and laboratory analysis indicated TCE concentrations in excess of 880 ug/kg in these soils. See Reference 1, especially Appendices A and B.

Mound Plant soil screening guidance equations[2] indicate that the TCE contaminated soils associated with PRS 417 may serve as a source of leachate to the Buried Valley Aquifer (BVA) at dissolved concentrations in excess of 5 ppb (MCL). Ohio EPA studies suggest that given the laboratory verified bulk soil TCE concentration of 880 ug/kg, it is theoretically possible to achieve TCE concentrations of about 80 ppb at the edge of the BVA. See Reference 1, Appendices C and D.

REFERENCES:

1) Limited Field Investigation (LFI) Volatile Organic Compounds In Monitoring Wells, Mound Plant, Miamisburg, Ohio, November 1998.
2) Potential Release Site Packages Reading and Understanding, Volume II (Preliminary), Appendix D4, August 7, 1996.

PREPARED BY:

Mark Gilliat, Member of Babcock & Wilcox of Ohio Technical Staff
Joseph Geneczko, Member of Babcock &Wilcox of Ohio Technical Staff

MOUND PLANT
PRS 417
Soil Contamination - High Soil Gas Near Well 0312

RECOMMENDATION:

CONCURRENCE:

DOE/MEMP: _____

Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA: _____

Timothy J. Fischer, Remedial Project Manager (date)

OEPA: _____

Brian K. Nickel, Project Manager (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from _____ to _____

☐ No comments were received during the comment period.

☐ Comment responses can be found on page _____ of this package.

Reference Material

LIMITED FIELD INVESTIGATION

VOLATILE ORGANIC COMPOUNDS IN MONITORING WELLS

FINAL

Mound Plant
Miamisburg, OH

November 1993

Department of Energy
Ohio Field Office

Prepared by the Soils Project of
BABCOCK & WILCOX OF OHIO

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ACRONYMS

BVA	Buried Valley Aquifer
CFR	Code of Federal Regulations
DOE	Department of Energy
DPT	Direct Push Technology
gpm	gallons per minute
LFI	Limited Field Investigation
MCL	Maximum Contaminant Level
MSL	Mean Sea Level
NPL	National Priorities List
PCE	Tetrachloroethene
ppb	parts per billion
PRS	Potential Release Site
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
TCA	1,1,1-Trichloroethane
TCE	Trichloroethane
VOC	Volatile Organic Compound
v/v	volume per volume

1.0 INTRODUCTION

The Mound Plant was placed on the National Priorities List (NPL) in 1989 because of volatile organic compounds (VOCs) contaminating the groundwater in the Buried Valley Aquifer (BVA). Since then, remedial investigations/feasibility studies (RI/FS) and remedial actions have focused on groundwater at Operable Unit 1. A Record of Decision (ROD) was signed for Operable Unit 1, and remediation is in progress.

Over 100 groundwater monitoring wells were installed as part of the RI/FS. The monitoring network included wells installed near Operable Unit 1. The network also includes wells installed on and around the Mound Plant with the objective of characterizing the site hydrogeology. These wells have been sampled and VOCs have been detected at some of the wells located away from Operable Unit 1. The Department of Energy (DOE) completed a Limited Field Investigation (LFI) to investigate the nature and extent of elevated levels of volatile organic compounds (VOCs) in four groundwater monitoring wells.

1.1 Objectives

The LFI was conceived with three objectives:

a. Identify VOC concentration trends or patterns in soil gas in the study area.

b. Identify VOC concentration trends or patterns in groundwater within the study area.

c. Determine if previously known or unknown potential release sites (PRS) were contributing to trends or patterns.

1.2 Area of Investigation

Several Mound groundwater monitoring wells outside of the OU 1 area have shown consistently elevated levels of trichloroethane (TCE). The wells include monitoring wells 0312, 0315, 0386 and 0389. Figure 1 shows the location of these Mound monitoring wells. Monitoring well 0312 is a "hybrid" well in that it is screened across the soil-bedrock interface. The remaining wells are completed in the Buried Valley Aquifer (BVA).

Sampling and analysis results for well 0312 have been consistently above the 40 CFR 141 Maximum Contaminant Level (MCL) of 5 parts per billion (ppb) for trichloroethane, with levels in the 20-50 ppb range. The results for the other wells have included TCE concentrations at or slightly above the MCL. The TCE concentrations with time are shown for each well in Figures 2 through 5.

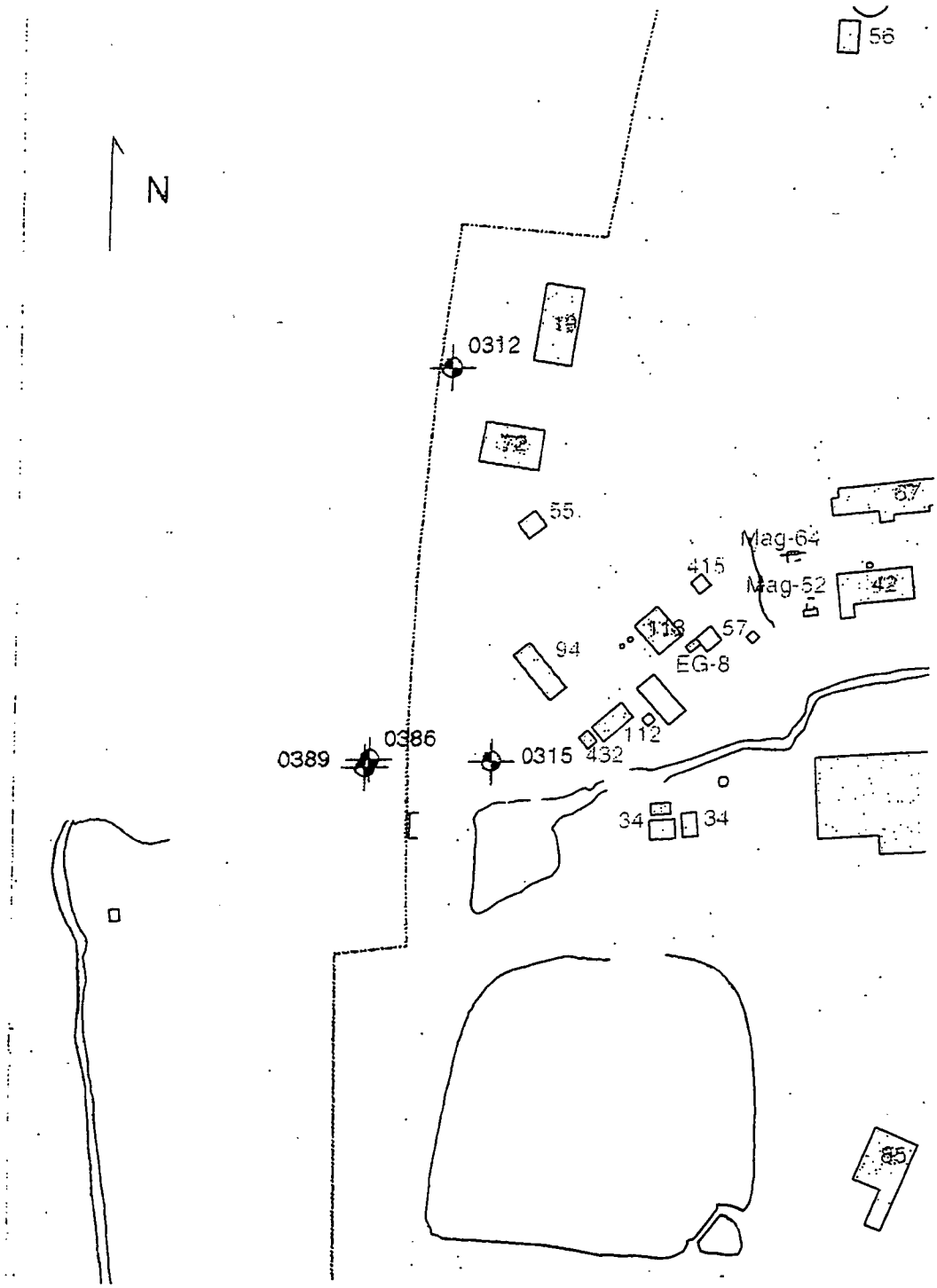

Figure 1 - Monitoring Well Location

TCE Concentration in Well 0312

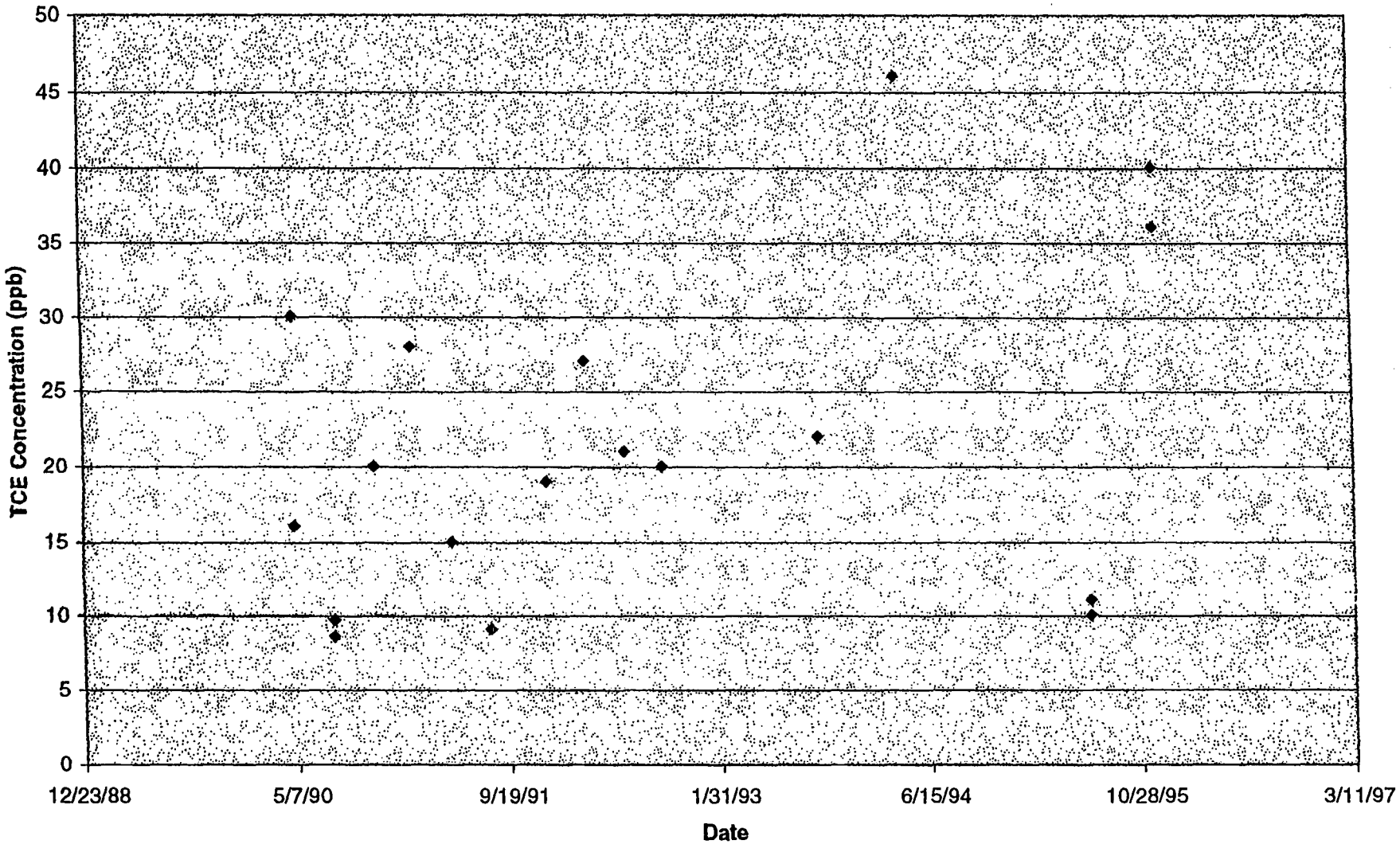

Figure 2

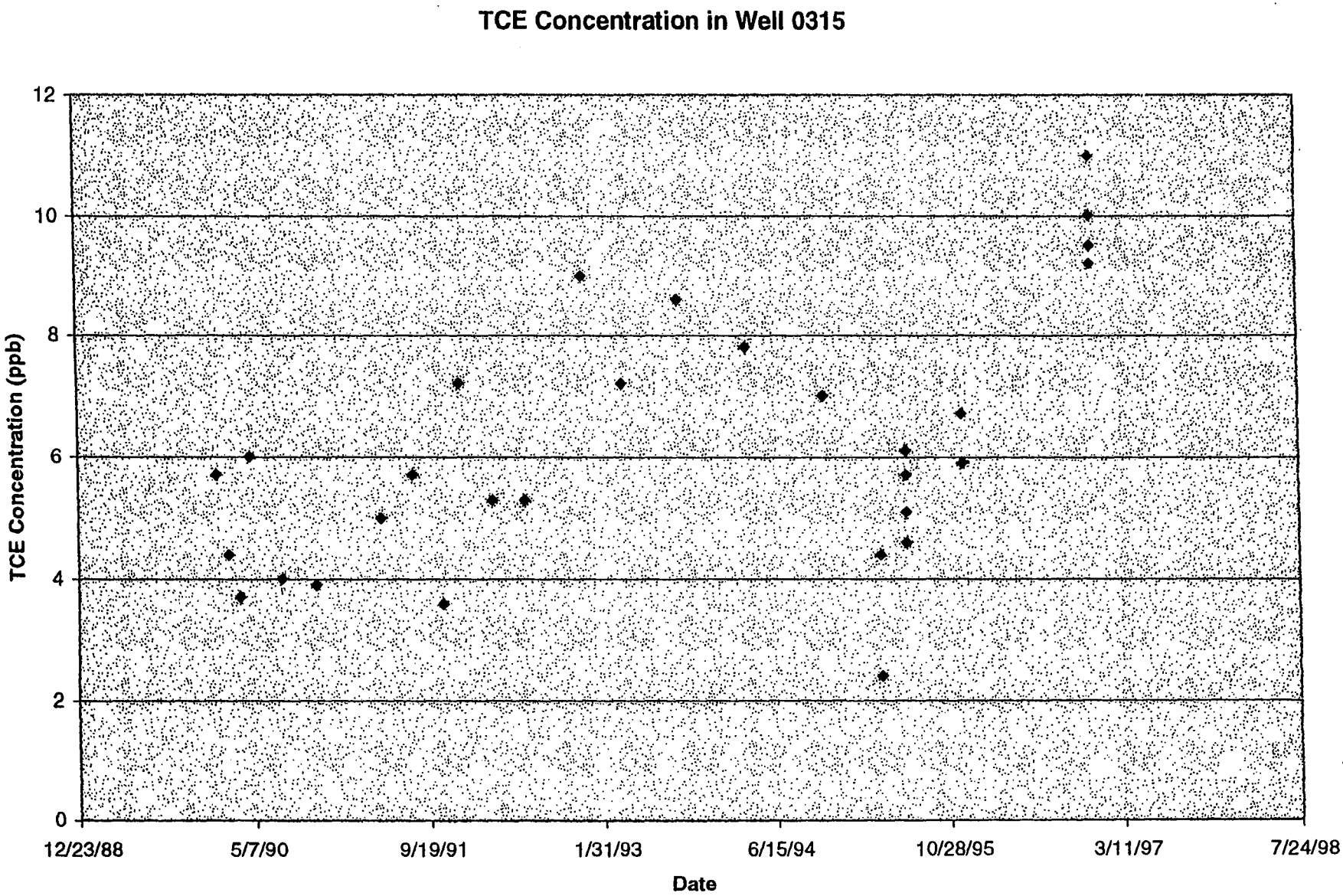
TCE Concentration in Well 0315
TCE Concentration (ppb)
12
10
8
6
4
2
0
12/23/88
5/7/90
9/19/91
1/31/93
6/15/94
10/28/95
3/11/97
7/24/98
Date

Figure 3

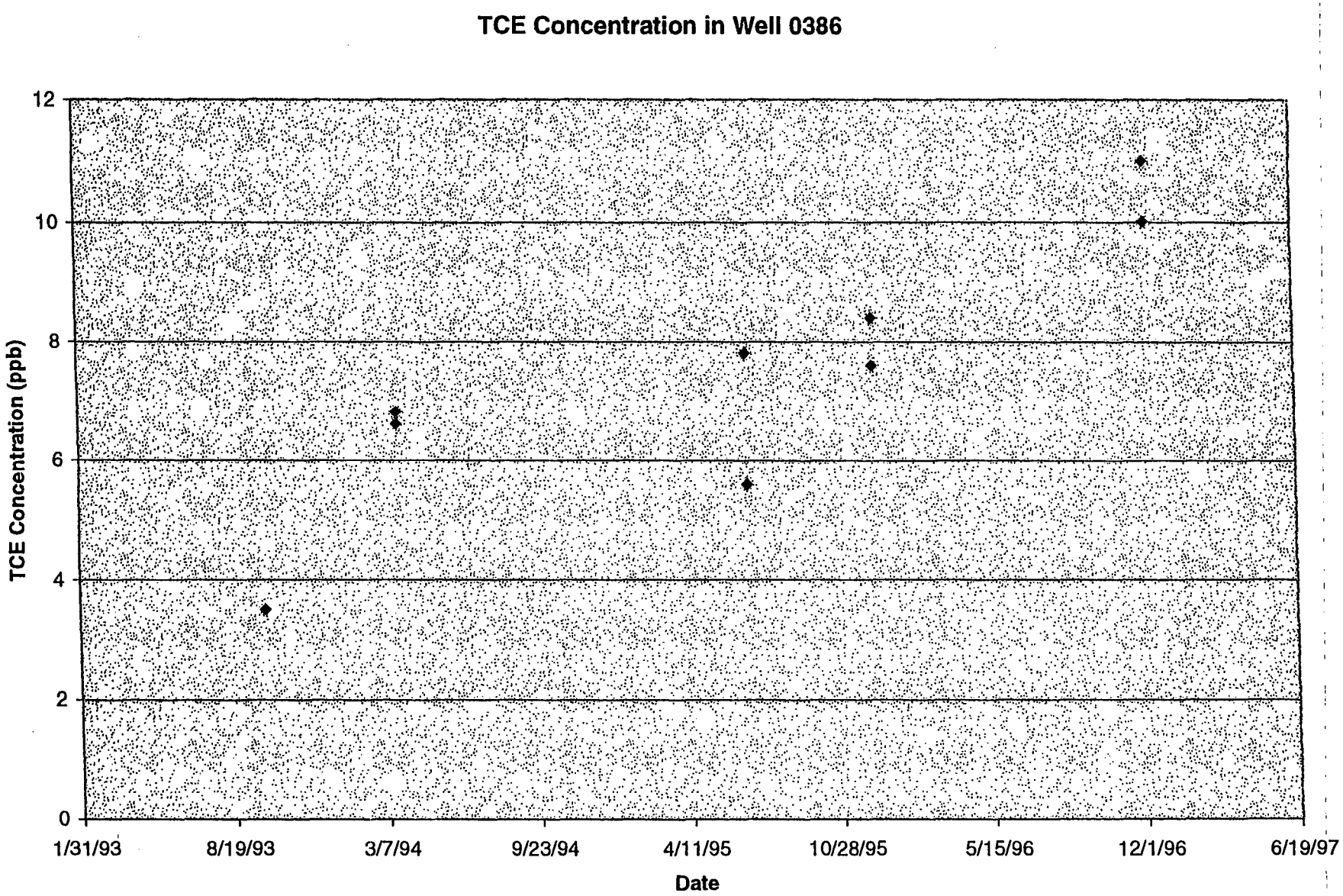
TCE Concentration in Well 0386
TCE Concentration (ppb)
12
10
8
6
4
2
0
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
5/15/96
12/1/96
6/19/97
Date

Figure 4

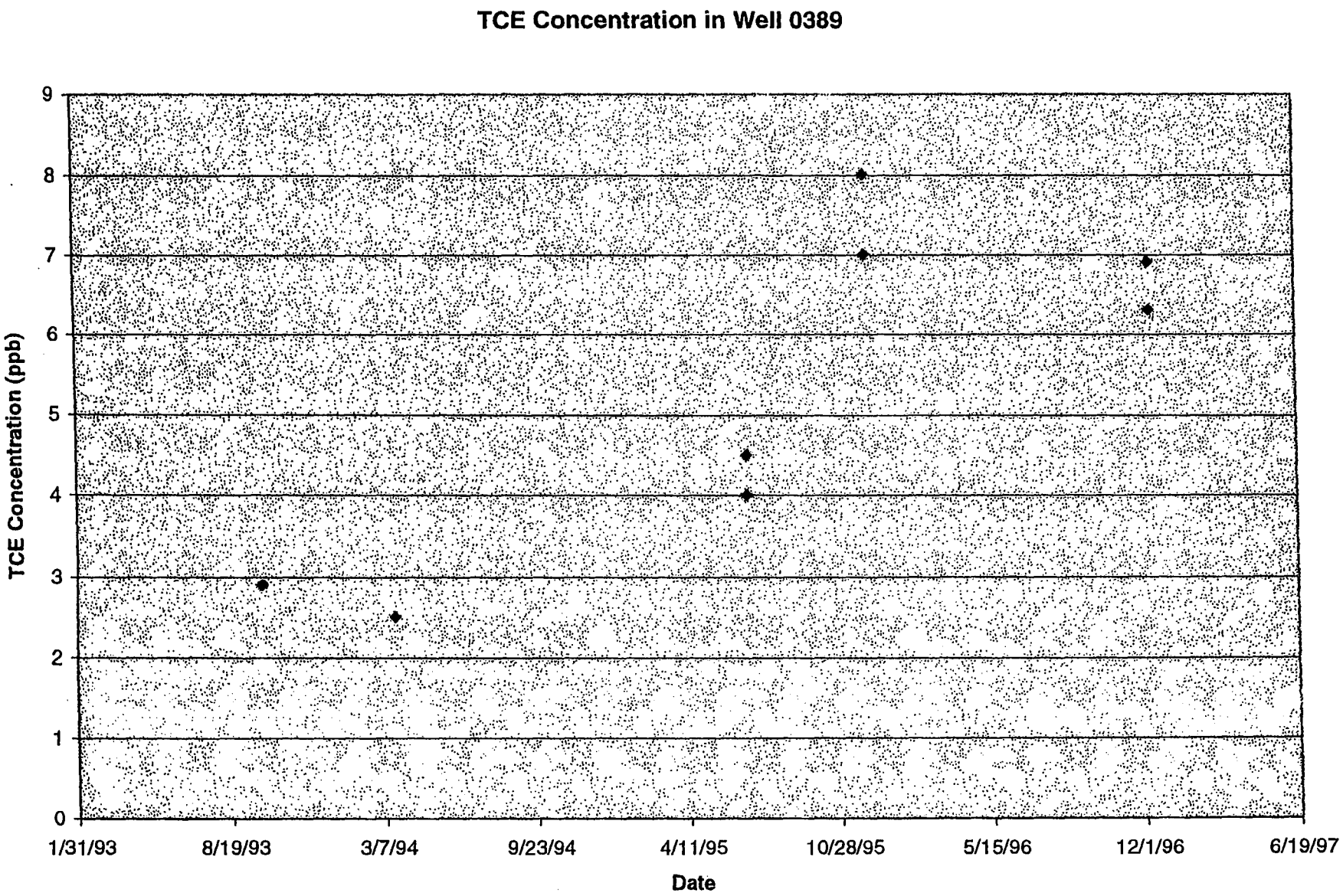

Figure 5

LFI Report - VOCs in Monitoring Wells
November, 1998

1.3 Previous Investigations

Soil gas surveys conducted at the Mound Facility in 1987 indicated elevated levels of VOCs in the soils adjacent to Building 19 (DOE, 1989). As a result, in 1989, monitoring well 0312 was installed to the west of Building 19. Additional soil gas surveys were conducted at the Mound Facility in 1992 and 1994. The 1992 survey was designed as a reconnaissance survey with the objective of providing data to enhance the planning of future site characterization (DOE, 1992). Two surveys were conducted in 1994. The first survey was site specific in that samples were collected from areas surrounding or near several buildings: Paint Shop, M, WD, DS, G and GW (DOE, 1994a). The second survey utilized the "Petrex" soil sampling methodology. Petrex samples are small canisters with an activated charcoal absorption element. The canisters are installed 18" below the surface with the charcoal element exposed to the soil gas for a specified time period (DOE, 1995). The 1992 and the first 1994 survey involved collection of shallow (generally less than 5 feet) soil gas samples, while the second 1994 survey sampled soil gas throughout the vertical soil profile. The results of all surveys indicated the occurrence of many low concentration detections located across much of the site with a limited number of locations showing relatively elevated (greater than 1,000 ppb v/v)VOC soil gas concentrations. Of particular interest to the current investigation are the 1992 soil gas survey results showing slightly elevated (66 ppb v/v) TCE concentrations adjacent to Building 19.

1.4 Investigation Plan

Technical experts devised an investigation plan consisting of :

a. Review of historical information including aerial photographs and the history of waste management at the Mound Plant.

b. Review of existing groundwater hydraulic (flow) data for the monitoring wells of interest.

c. Complete sampling and analysis using direct push technology (DPT) and real time sampling analysis.

This LFI Report describes the results of those investigations.

2.0 RESULTS

2.1 Historical Review

A historical review of waste management activities at the Mound Plant did not reveal any documented treatment of storage or disposal activities with the exception of activities at OU 1 involving VOCs near the area of investigation (DOE, 1993). Historical aerial photographs were used to identify suspect areas within the area of investigation. The photographs spanned the time period from 1949 through 1985. Additionally, the Operable Unit 9, Site Scoping Report Volume 6, Photo History Report was reviewed. These suspect areas are:

Area 1 Identified on a 1949 aerial photograph (unpublished, scale 1" = 200') as a drainage ditch from the top of the main hill. This ditch could have captured and carried contaminants from the main hill, if any were present. There is no documented history of discharge of contaminants into the ditch.

Area 2 This area was identified on the 1959 photograph (scale 1" = 800') as fill material and later on the 1965 photograph it appeared that drums were staged at this location.

Area 3 The 1965 photograph (unpublished, no scale) indicated the presence of drums being stored at this location.

Area 4 The 1968 aerial photograph (scale 1" = 1000') showed drums staged along the north side of Building 67.

Area 5 A vehicle turn around area was identified on the 1959 photograph (scale 1" = 800'). There is no documentation of waste treatment, storage or disposal at the turnaround.

Area 6 The 1973 photograph (scale 1" = 1000') showed potential cargo boxes along the railroad spur. There is no documentation of VOCs in the cargo boxes.

Area 7 The 1973 photograph (scale 1" = 1000') revealed the presence of possible drum storage in this area to the northwest of the present day large retention basin.

Area 8 Operable Unit 5, Area 3 Petrex soil gas study detected elevated halogenated hydrocarbons.

The historical review did not find written documentation to confirm or refute treatment, storage or disposal of VOCs at the locations indicated by the photographic record. The suspect areas are shown in Figure 6.

A review of the current Potential Release Site (PRS) map indicates several PRSs lie within the area encompassing the suspect areas. None of the PRSs coincides directly with an identified suspect area. These PRSs do not involve contamination associated with halogenated organic compounds.

2.2 Field Sampling and Analysis

A 50 foot by 50 foot sampling grid was designed that allowed efficient coverage of the large sample area at a frequency that would allow trends in soil and groundwater contamination to become apparent. Figure 6 shows the grid layout superimposed over the study area.

Sampling involved utilizing a van-mounted hydraulically driven Geoprobe™ Model M sampling probe. It uses DPT to force a sampling probe into the ground. The van was also equipped with a gas chromatograph allowing for immediate VOC analysis of soil gas and groundwater samples. At each sampling location, in-situ soil gas samples were collected at five foot intervals until groundwater was encountered. Once groundwater was encountered, groundwater samples were collected every five feet until bedrock was encountered. Results of the onsite analysis of soil gas and groundwater VOC concentrations were plotted on the sampling grid to identify contamination trends and help identify areas requiring more detailed sampling.

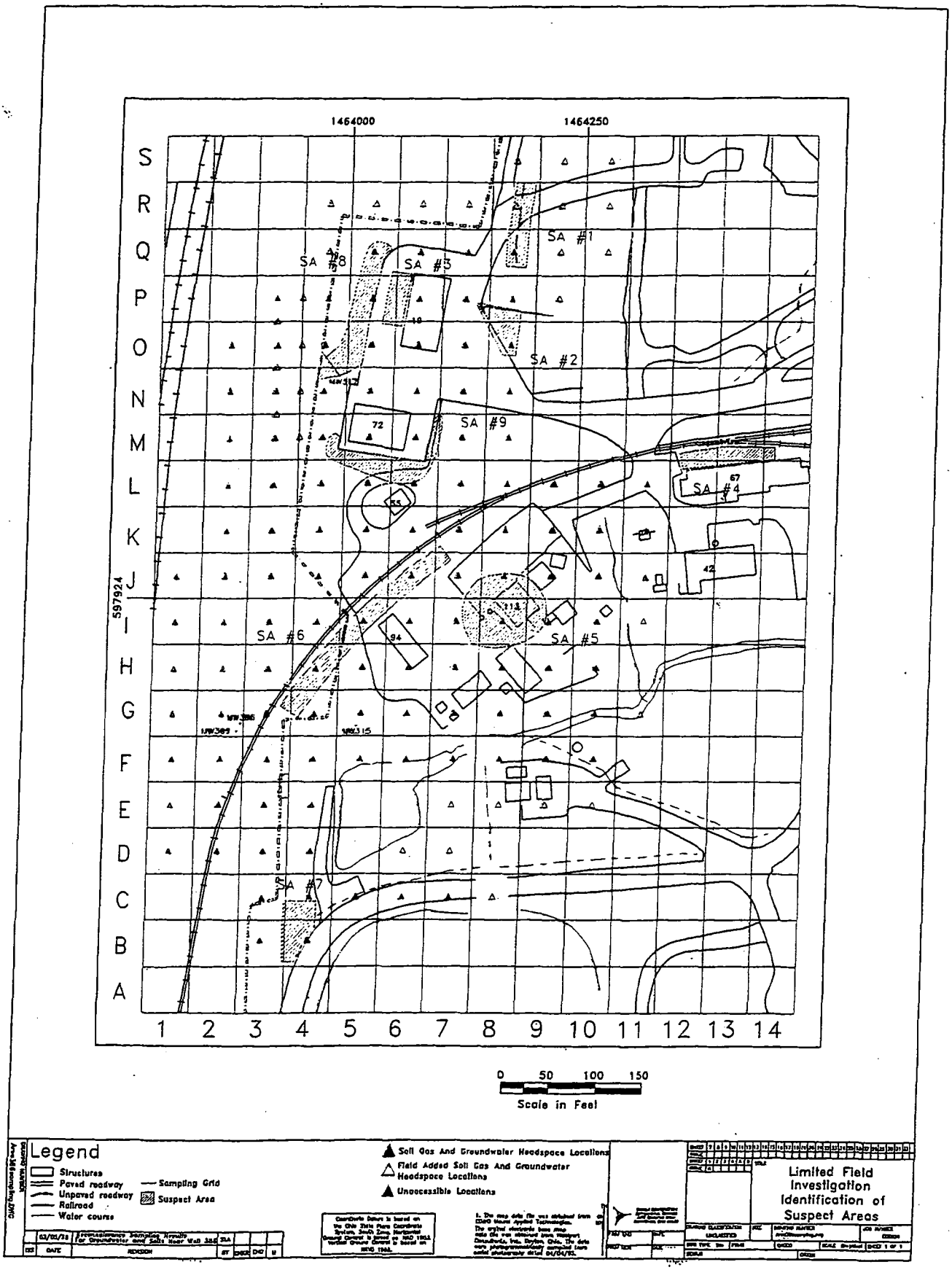

Figure 6 - "Suspect Areas" & Grid Layout

2.2.1 Field Results

The results of the field sampling are shown in Appendix A. Figure 7 shows the spatial distribution of the highest VOC concentration soil gas sample and groundwater sample detected at each sampling location Figures 8 and 9 show the distribution of TCE soil gas and 1,1,1-Trichloroethane (TCA) soil gas detections greater than 5 ppb respectively. Bulk soil confirmation samples were collected and analyzed to verify the field results. The bulk soil results for TCE are shown in Appendix B.

Examination of the data indicate that there is no discernable trend in soil gas or groundwater VOC concentrations. A large proportion of the sampling locations showed either non detectable quantities of VOCs in both soil gas and groundwater or extremely low levels. The field results indicate that the only trend or pattern observed are in the form of the isolated VOC hotspot found near monitoring well 0312. As a result, the remainder of this report will focus on the region around well 0312.

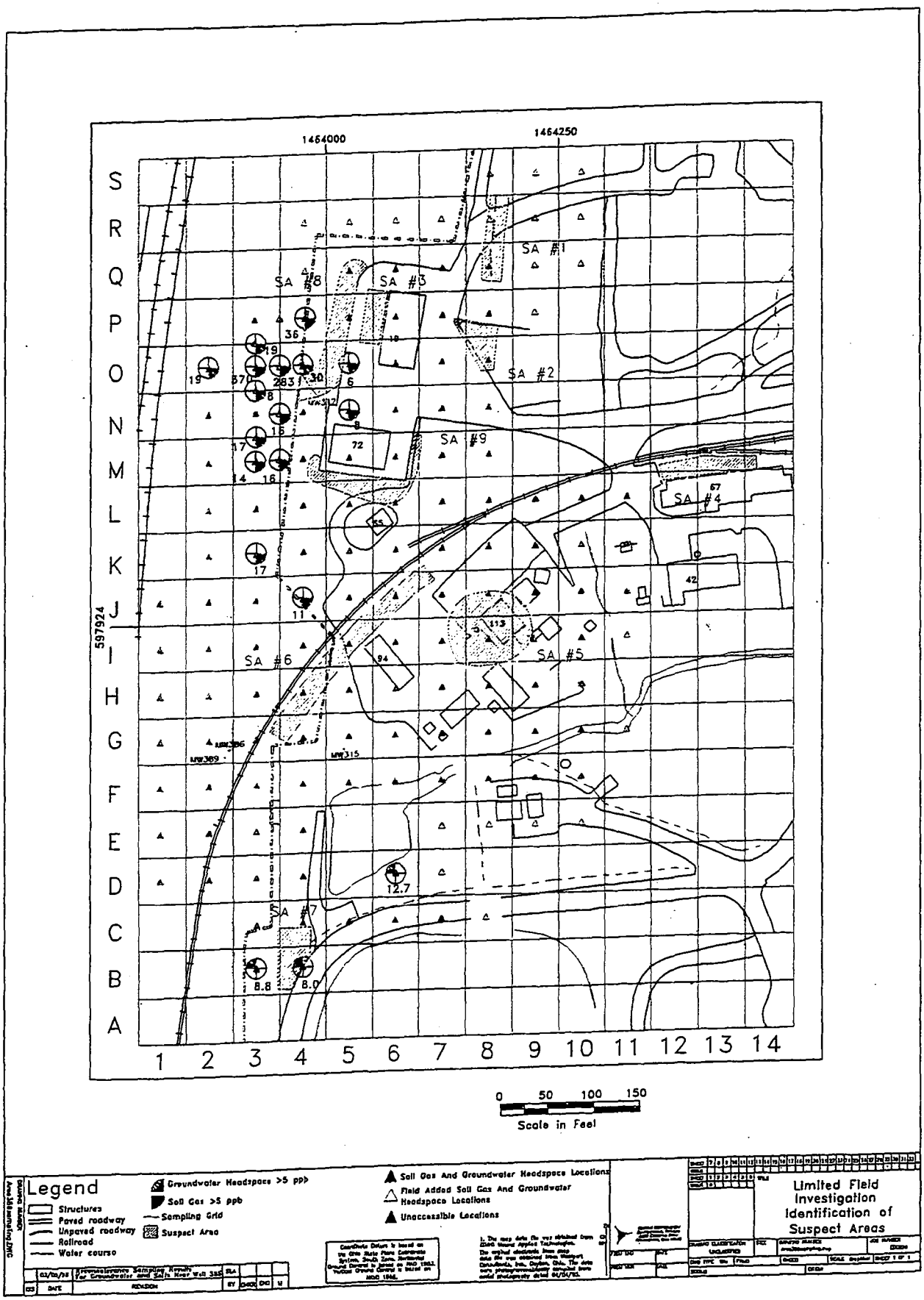

Figure 7 - Highest VOC Concentrations

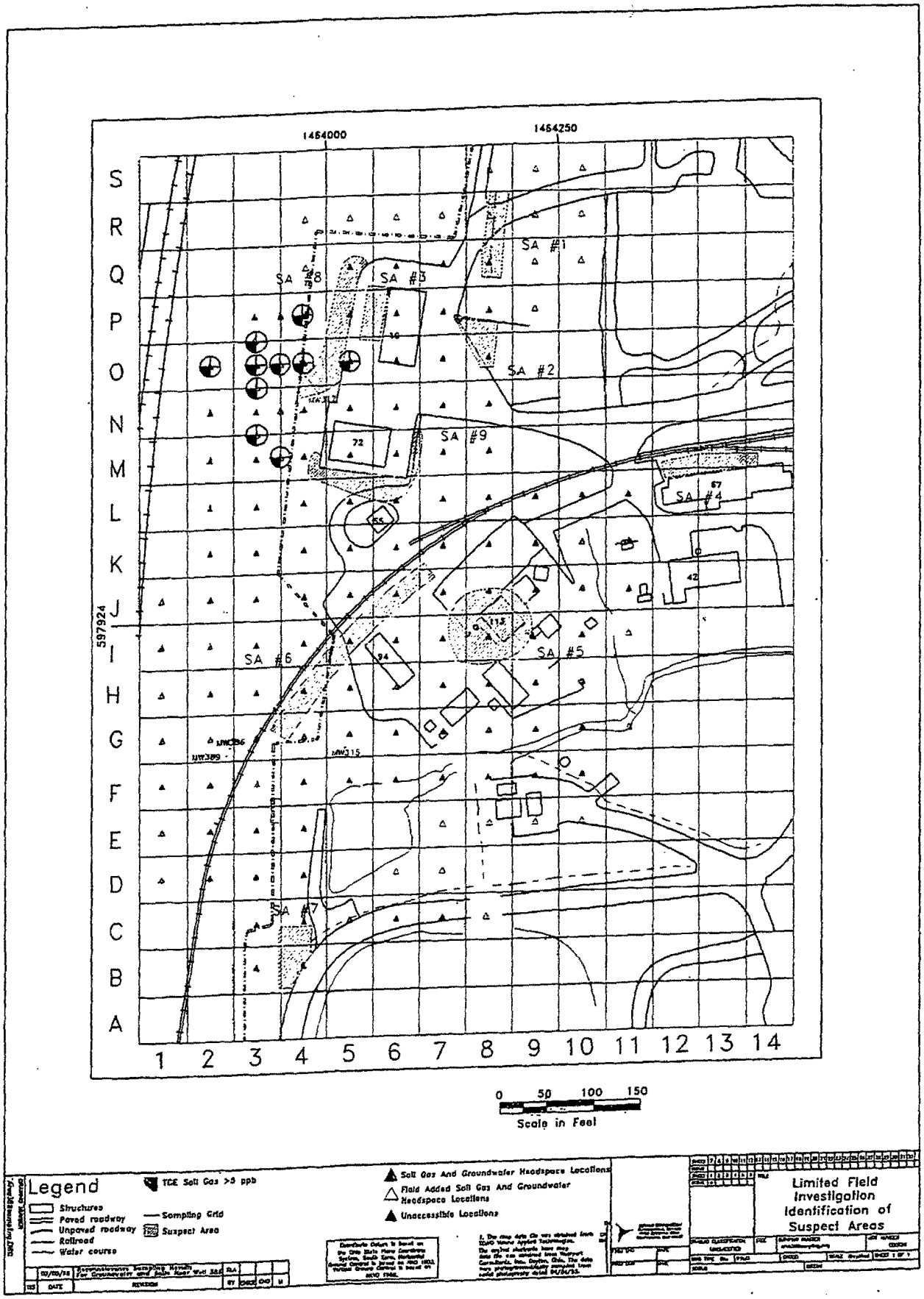

Figure 8 - TCE Soil Gas > 5 ppb

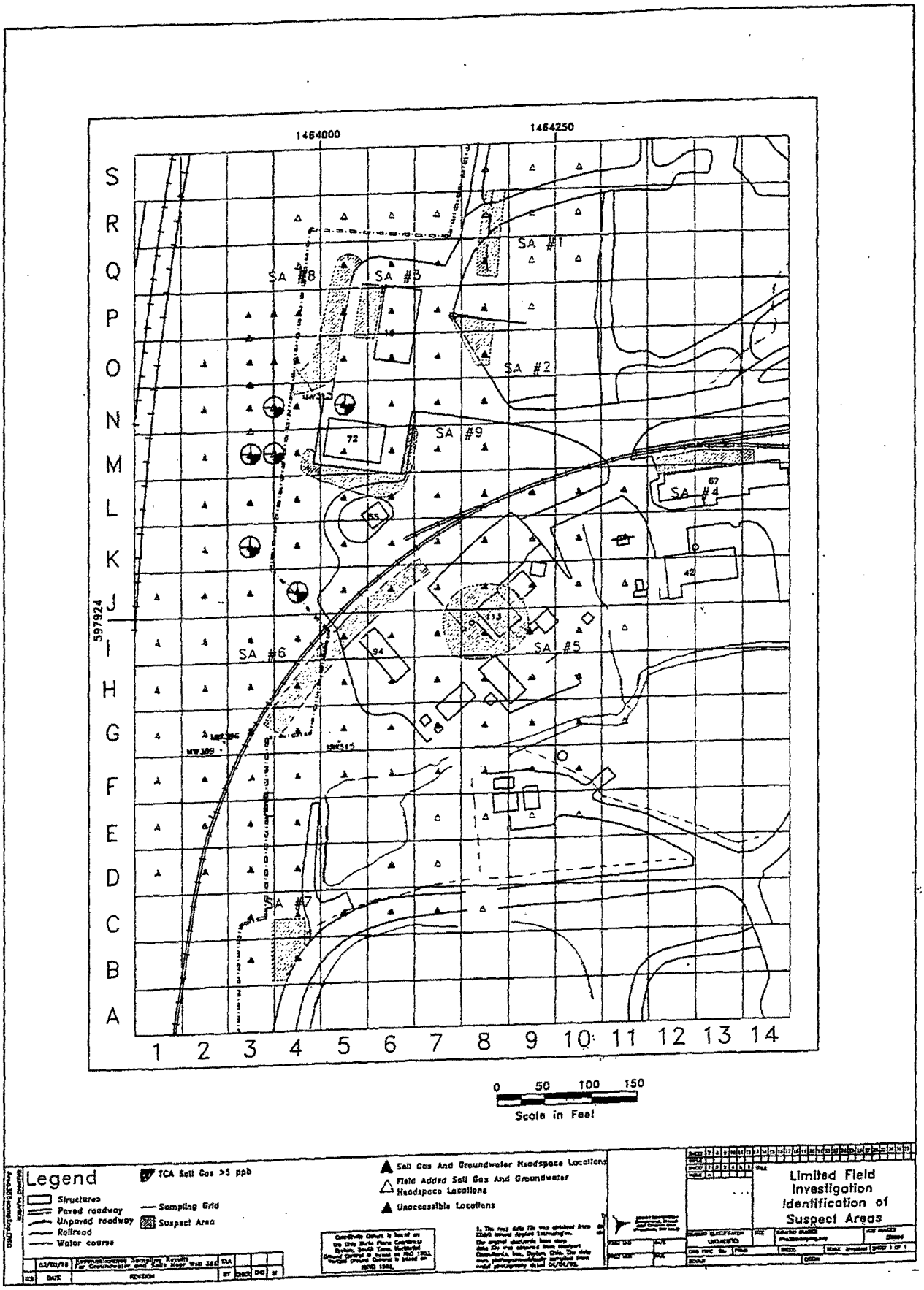

Figure 9 - TCA Soil Gas > 5 ppb

3.0 DISCUSSION OF AREA NEAR MONITORING WELL 0312

3.1 Geology

Well 0312 is located just beyond the plant boundary to the west of Building 19. Well 0312 was installed in late 1989. The well is a four inch diameter stainless steel well screened across the vadose zone-bedrock interface. Figure 10 shows the geologic log associated with well 0312. The lithologic sequence consists of sandy clays in the upper 15 feet grading to an approximately 8 foot thick section of clayey sandy gravel overlying greenish-grey shale bedrock. The bedrock surface slopes fairly steeply in the vicinity of the well with elevation rising rapidly to the northeast and dropping quickly to the southwest (see Figure 11). The well is screened considerably above the BVA water table elevation and therefore is not in direct hydraulic connection with BVA groundwater.

3.2 Groundwater Data

An analysis of historical groundwater levels in monitoring well 0312 reveals that the well consistently holds water at an elevation of approximately 700 feet (Figure 12). This data seems to contradict water level monitoring data from other Mound wells, which indicates seasonal fluctuations of groundwater. The water level data indicates that well 0312 may simply act as a "sump" pit, intercepting and collecting water moving down slope along the soil-bedrock interface with subsequent transfer out of the well into the fractured bedrock. Although not verified by field results, the inflow to the well most likely represents a small flux of water associated with unsaturated flow along the soil-bedrock interface. The rate of inflow into the well appears to meet the rate of outflow as evidenced by the relatively constant water elevation of 700 ft. If the well was actually in contact with a saturated portion of the bedrock it would be anticipated that the water levels would vary considerably more than is seen in the data. The variation would reflect the periodic response of the water table to precipitation recharge events.

The following field data lends indirect evidence in support of the above hypothesis:

a. Falling head tests previously conducted to determine hydraulic characteristics of the bedrock flow system indicate that wells screened in the upper portion of the fracture carapace are able to sustain water inflow rates less than 1 gallon per minute (gpm) (DOE, 1994b). The likelihood of a low inflow rate, controlled by the hydraulic conductivity of the rock, is consistent with the concept that well 0312 may act as a sump, intercepting water across the soil/bedrock interface and subsequently transferring water out through the fracture zone (i.e. inflow rate approximately equal to the outflow rate).

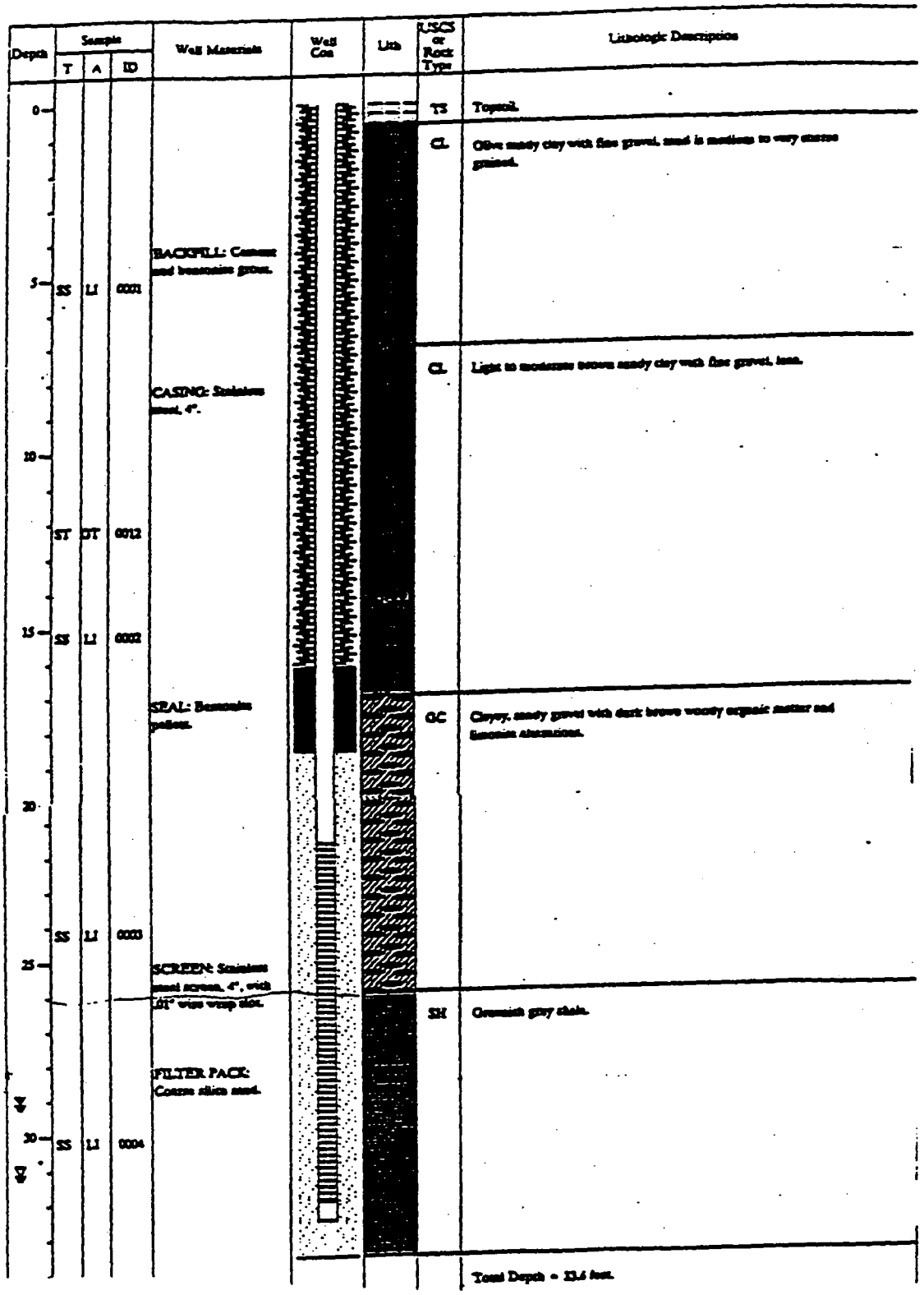

Figure 10 - Geologic Log of Well 0312

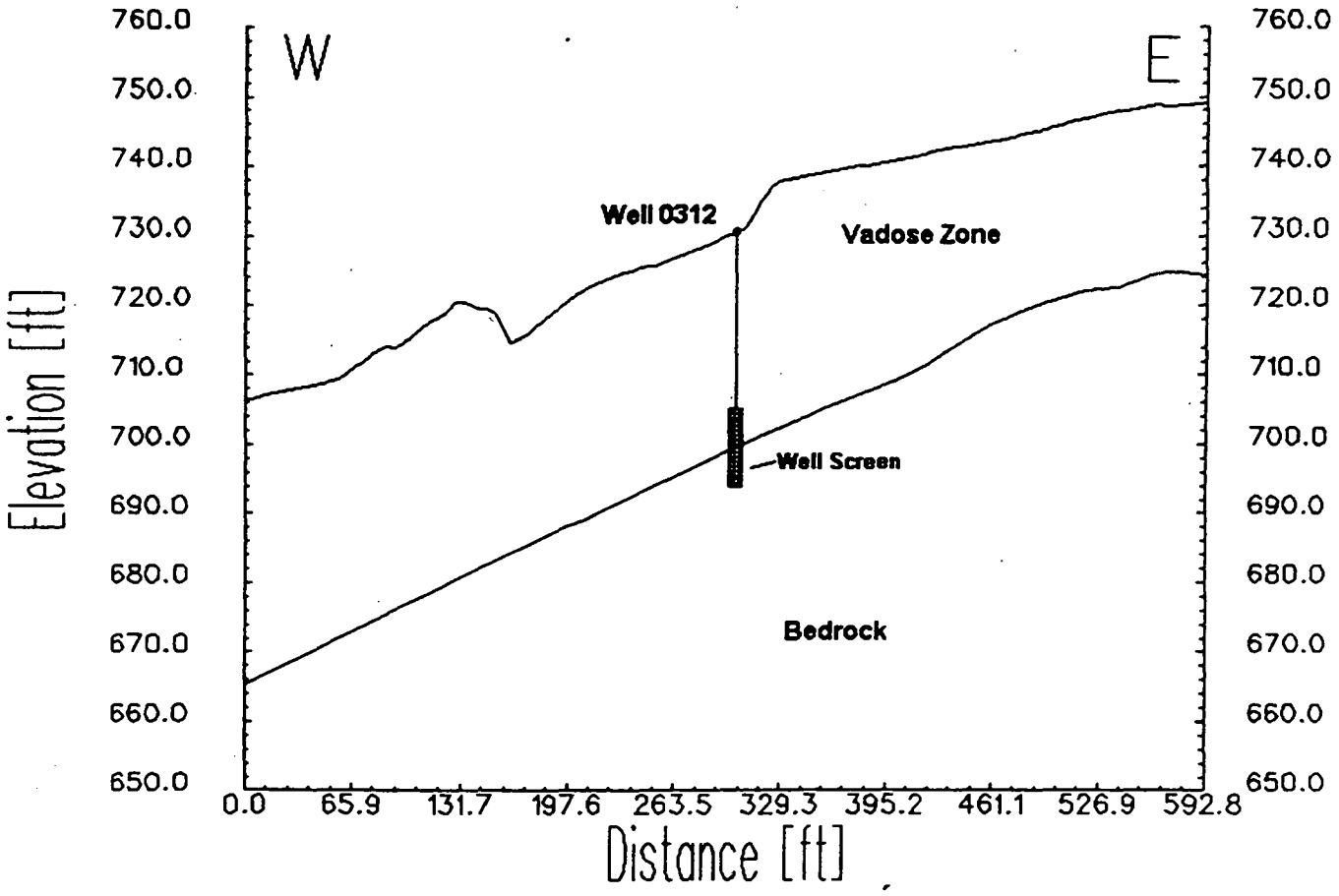

Figure 11 - Cross Section

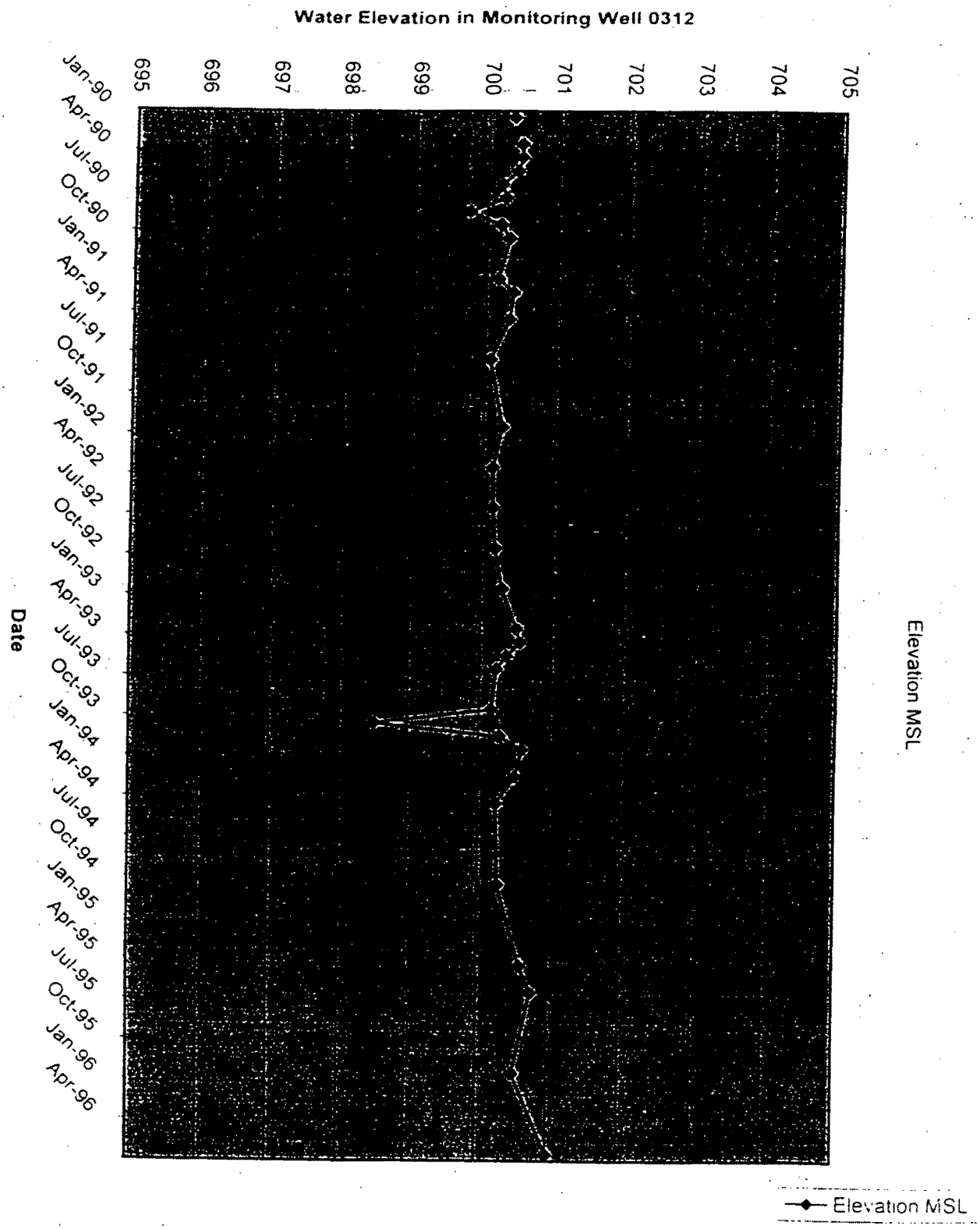

Figure 12 - Water in Well 0312

b. During the geoprobe field study, a 2 inch continuous soil core sample was collected near 0312. It was noted that the soil at the bedrock interface was quite moist relative to the sediments in the upper portion of the sequence. This information supports the concept that the soil/bedrock interface collects and transfers water down slope.

c. Seep 601 data indicates a continual source of water uphill from well 0312. Figure 13 shows seep discharge in gallons per minute throughout the year. The seep flows year round even during extended periods of little or no precipitation. The continual water source has been speculated to represent leakage from pressurized underground water utility lines.

Appendix E contains a hypothetical determination of potential water flux into well 0312 utilizing estimated hydraulic parameters for the soil. The calculation shows it is reasonable to conclude the well may be receiving continual inflow from the overlying unsaturated interface.

Vertical infiltration of water through the vadose from precipitation and precipitation runoff is also a likely source of recharge to well 0312. A study was conducted to determine the spatial relationship of the fluid potential in the vicinity of well 0312. Fluid potential is an important measure of the energy status of soil water, and spatial differences in potential indicate direction of soil-water movement (Stephens, 1996). Three tensiometers were installed at depths of 24, 36 and 60 inches below the surface. The tensiometers measure soil suction in centibars (this gives a direct measure of the fluid potential in the soils adjacent to the tensiometer). Data from the tensiometers were collected during August and September of 1997. The data is presented in Figure 14. The data indicates a general decrease in soil water potential with depth between the tensiometers installed between 24 and 36 inches. This would indicate a downward flow gradient. In the case of the deeper tensiometer, the data appears to show the opposite trend. This is most likely due to transient variances in the soil water content throughout the soil rather than an indication of a long-term upward gradient.

Preliminary Data for Seep 601
Discharge and Rainfall Correlation

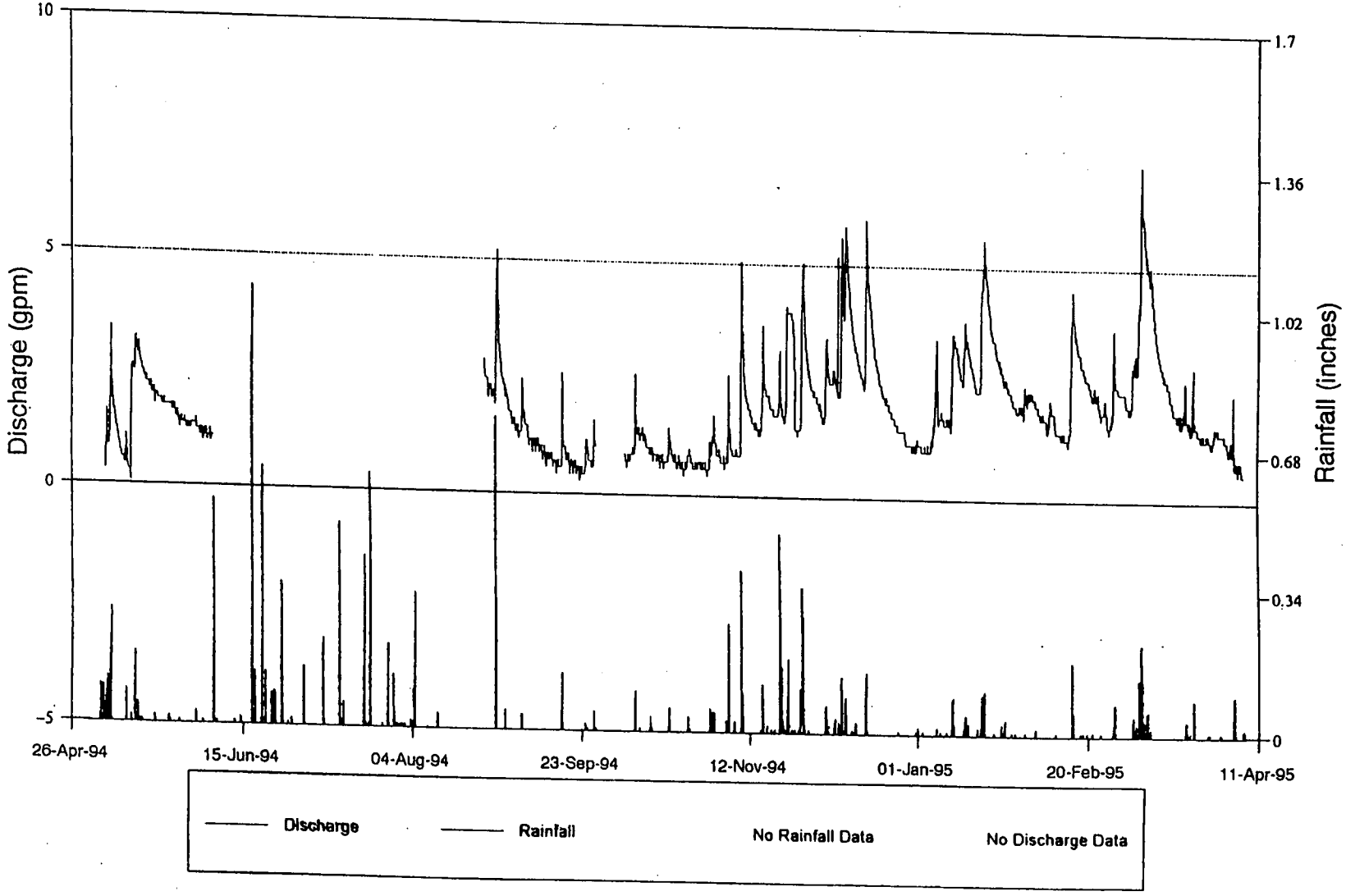

Figure 13

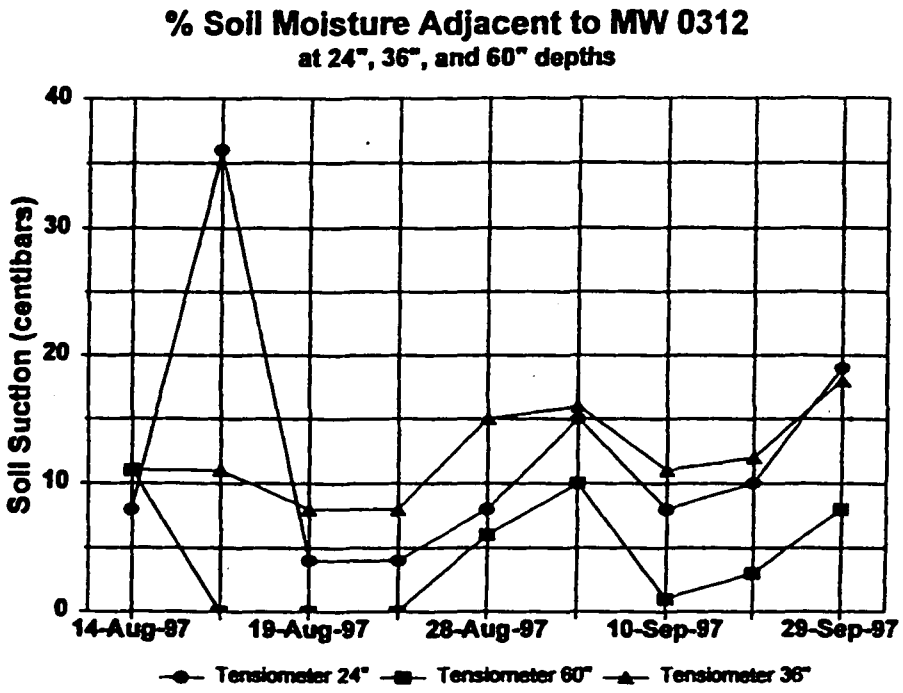

Figure 14 - Tensiometer Data

4.0 CONCLUSIONS

4.1 Discussion of Geoprobe Field Investigation

Results of the field soil gas and groundwater headspace analyses reveal no discernable trends in VOC contamination. There were isolated detections of 1,1,1-trichloroethane (TCA) in the soil gas and tetrachloroethene (PCE) in the groundwater headspace analyses. The LFI indicates that there is not a widespread VOC contaminant source in the soil or groundwater within the study area.

The VOC levels seen in monitoring wells 0315, 0386 and 0389 do not appear to be related to widespread soil or groundwater contamination. The data does indicate a region of elevated TCE soil gas levels in the vicinity of monitoring well 0312. Field gas chromatograph data indicates TCE soil gas levels in excess of 300 ppb in soils immediately west of monitoring well 0312. Sample grid-point O3 indicates elevated TCE soil gas levels at all depths sampled (Appendix A). The elevated levels suggest that there was likely a spill or other release of TCE onto the soil somewhere in the vicinity of monitoring 0312.

The highest soil gas levels encountered during the LFI were in the lower 300 ppb range. This represents less than a few hundredths of a percent of the TCE saturated vapor concentration. The field data therefore suggest that the TCE soil gas levels are not indicative of highly contaminated soil but rather appears to represent low level residual TCE contamination in the soil.

4.2 Discussion of Possible Mechanisms for Transport of Contaminant to Well 0312

Two mechanisms for transfer of water into well 0312 were discussed in Section 3. Those two physical mechanisms are: 1) interception of water moving in the vadose zone along the soil-bedrock interface and 2) intercepting water moving vertically through the vadose zone into the upper well screen of well 0312. The first mechanism involves transport of water to the well from a water source up slope from well 0312. That water source has been suggested to represent the same source that supplies continual flow to seep 601 (i.e. buried leaky pressurized water utility lines). The second mechanism involves downward percolation of water resulting from precipitation events. The contaminant source for each mechanism appears to represent two unrelated sources. In Case 1 (interception of water moving along the interface), examination of the LFI field data does not indicate soil contamination up slope from well 0312. However, the water chemistry data collected from seep 601 reveals that seep water does have low concentrations of VOCs including TCE. This most likely represents a situation where the source is located outside the area covered by this LFI. In Case 2 (downward percolation of water through the vadose zone)

the field data clearly shows a potential TCE source zone in the vicinity of well 0312. The source zone could be associated with the previously identified suspect Area #3 (a 1965 aerial photograph showing potential drum storage behind Building 19). Data from the tensiometer study supports the water percolation mechanism showing that a downward hydraulic gradient is present in the upper vadose zone. As water infiltrates down through the vadose zone it comes into contact with the TCE contaminated soils. TCE could then partition into the liquid phase and subsequently be transferred down to the well screen and into the wellbore.

5.0 SUMMARY

5.1 Additional Field Work to Further Refine Source Areas

The LFI demonstrated that there is not a widespread source of VOC contamination in the soils and groundwater within the study area. There are several isolated hot-spots. These isolated hot spots are not reflected in widespread elevated VOCs in groundwater and are not therefore providing a significant source of VOCs to the Buried Valley Aquifer. Mound continues to maintain an extensive groundwater monitoring network capable of detecting the movement of VOC contaminants from the study area into the BVA. As a result, it is sufficient to continue to periodically monitor the wells for VOCs in the study area and down gradient of the study area.

5.2 Elevated Soil TCE Concentrations in the Vicinity of Well 0312

The LFI showed localized TCE soil contamination near well 0312. This region is at an elevation significantly above the BVA (i.e. BVA water elevation is approximately 680 ft MSL and the base of the screen at well 0312 is at an elevation of approximately 700 ft MSL). The Mound soil screening guidance equations were applied to the soils overlying the bedrock aquifer system in the vicinity of well 0312 to evaluate the potential for these soils to serve as a source of TCE to the BVA. The model results indicate that the soils may serve as a source of leachate to the BVA with dissolved TCE concentration in excess of 5 ppb, (see Appendix C). Additional work conducted by the Ohio Environmental Protection Agency suggests that given bulk soil TCE concentration in excess of 800 ug/kg (highest soil confirmation sample) it is theoretically possible to achieve TCE concentrations of about 80 ppb at the edge of the BVA, (see Appendix D).

6.0 REFERENCES

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Stephens, D.B. "Vadose Zone Hydrology". CRC, Lewis Publishers, 1996.

APPENDIX A

Field Data

Grid Location	Sample Date	Sample Type	Parameter	Feet Below Ground Surface	Concentration (ppb)	Det. Limit (ppb)	Qualifier
B3	08-Jul-97	SG	TCE	10	ND	5	
B3	08-Jul-97	SG	TCE	15	ND	5	
B3	08-Jul-97	SG	TCE	25	ND	5	
B3	08-Jul-97	GW	TCE	38.9	0.7	5	J
B3	08-Jul-97	GW	TCA	38.9	0.3	5	J
B3	08-Jul-97	GW	PCE	38.9	8.8	5	
B4	14-May-97	SG	TCE	5	ND	5	
B4	14-May-97	SG	TCE	10	ND	5	
B4	14-May-97	SG	TCE	15	ND	5	
B4	14-May-97	GW	TCE	34	0.9	5	J
B4	14-May-97	GW	PCE	34	6.7	5	
B4	14-May-97	GW	TCE	39.2	1.5	5	J
B4	14-May-97	GW	PCE	39.2	8	5	
C3	08-Jul-97	SG	TCA	5	0.4	5	J
C3	08-Jul-97	SG	TCE	5	ND	5	
C3	08-Jul-97	SG	TCE	10	ND	5	
C3	08-Jul-97	SG	PCE	10	0.4	5	J
C3	08-Jul-97	SG	TCA	10	0.1	5	J
C3	08-Jul-97	SG	TCE	15	ND	5	
C3	08-Jul-97	SG	PCE	15	0.1	5	J
C3	08-Jul-97	SG	TCA	15	0.4	5	J
C3	08-Jul-97	SG	TCE	20	ND	5	
C3	08-Jul-97	SG	PCE	20	0.7	5	J
C3	08-Jul-97	SG	TCA	20	0.6	5	J
C3	08-Jul-97	SG	TCE	25	ND	5	
C3	08-Jul-97	SG	PCE	25	0.7	5	J
C3	08-Jul-97	SG	TCA	25	0.5	5	J
C3	08-Jul-97	SG	TCE	28	ND	5	
C3	08-Jul-97	SG	PCE	28	0.2	5	J
C3	08-Jul-97	SG	TCA	28	0.5	5	J
C3	08-Jul-97	GW	No Water Detected				
C4	13-May-97	SG	TCE	5	ND	5	

Grid Location	Sample Date	Sample Type	Parameter	Feet Below Ground Surface	Concentration (ppb)	Det. Limit (ppb)	Qualifier
D3	09-Jul-97	SG	TCE	25	ND	5	
D3	09-Jul-97	SG	TCA	25	0.4	5	J
D3	09-Jul-97	SG	PCE	25	0.3	5	J
D3	09-Jul-97	GW	TCE	32.4	ND	5	
D3 - Dup. Sample	09-Jul-97	SG	TCE	20	ND	5	
D3 - Dup. Sample	09-Jul-97	SG	TCA	20	0.1	5	J
D3 - Dup. Sample	09-Jul-97	SG	PCE	20	0.1	5	J
D4	13-May-97	SG	TCE	5	ND	5	
D4	13-May-97	SG	TCE	10	ND	5	
D4	13-May-97	SG	TCE	15	ND	5	
D4	13-May-97	GW	TCE	21.2	ND	5	
D6	16-May-97	SG	TCE	5	ND	5	
D6	16-May-97	SG	TCE	10	ND	5	
D6	16-May-97	SG	TCE	15	ND	5	
D6	16-May-97	SG	TCE	20	ND	5	
D6	16-May-97	GW	TCE	38	ND	5	
D6	16-May-97	GW	TCA	38	4.6	5	J
D6	16-May-97	GW	PCE	38	2.5	5	J
D6	16-May-97	GW	TCE	43.2	ND	5	
D6	16-May-97	GW	TCA	43.2	2.7	5	J
D6	16-May-97	GW	PCE	43.2	12.7	5	
D6 - Dup. Sample	16-May-97	GW	TCE	43.2	ND	5	
D6 - Dup. Sample	16-May-97	GW	TCA	43.2	2.5	5	J
D6 - Dup. Sample	16-May-97	GW	PCE	43.2	12.8	5	
D7	19-May-97	SG	TCE	10	ND	5	
D7	19-May-97	GW	No Water Detected				
E1		SG	Obstructed by Trees and Grade			5	J
E1		GW	Obstructed by Trees and Grade			5	J
E10	22-May-97	SG	TCE	24	ND	5	
E10	22-May-97	GW	No Water Detected				
E2	18-Jun-97	SG	TCE	5	ND	5	
E2	18-Jun-97	SG	TCE	10	ND	5	
E2	18-Jun-97	SG	TCE	15	ND	5	

Grid Location	Sample Date	Sample Type	Parameter	Feet Below Ground Surface	Concentration (ppb)	Det. Limit (ppb)	Qualifier
F2	18-Jun-97	SG	TCE	20	ND	5	
F2	18-Jun-97	GW	TCE	45	0.3	5	J
F2	18-Jun-97	GW	TCA	45	1	5	J
F2	18-Jun-97	GW	TCE	50	0.4	5	J
F2	18-Jun-97	GW	TCA	50	1	5	J
F2	18-Jun-97	GW	TCE	55	0.5	5	J
F2	18-Jun-97	GW	TCA	55	1	5	J
F2	18-Jun-97	GW	TCE	59.2	2.1	5	J
F2	18-Jun-97	GW	TCA	59.2	1	5	J
F2	18-Jun-97	GW	PCE	59.2	1	5	J
F2 - Conf. Sample Lo	18-Jun-97	GW	TCE	49	0.4	5	J
F2 - Conf. Sample Lo	18-Jun-97	GW	TCE	53.8	0.1	5	J
F3		SG	Obstructed by Grade				
F3		GW	Obstructed by Grade				
F4	19-May-97	SG	TCE	10	ND	5	
F4	19-May-97	SG	TCE	15	ND	5	
F4	19-May-97	SG	TCE	20	ND	5	
F4	19-May-97	GW	No Water Detected				
F5		SG	Obstructed by Trees and Grade				
F5		GW	Obstructed by Trees and Grade				
F6		SG	Obstructed by Trees and Grade				
F6		GW	Obstructed by Trees and Grade				
F7		SG	Obstructed by Trees and Grade				
F7		GW	Obstructed by Trees and Grade				
F8		SG	Obstructed by Ditch and Grade				
F8		GW	Obstructed by Ditch and Grade				
F9	21-May-97	SG	TCE	10	ND	5	
F9	21-May-97	SG	TCE	25	ND	5	
F9	21-May-97	GW	No Water Detected				
G1		SG	Obstructed by Trees and Grade				
G1		GW	Obstructed by Trees and Grade				
G10	04-Jun-97	SG	TCE	5	ND	5	
G10	04-Jun-97	SG	TCE	10	ND	5	

Grid Location	Sample Date	Sample Type	Parameter	Feet Below Ground Surface	Concentration (ppb)	Det. Limit (ppb)	Qualifier
G6	28-May-97	GW	TCE	38.9	ND	5	
G6 - Conf. Sample Lo	28-May-97	GW	TCE	43.8	ND	5	
G7	30-Jun-97	SG	TCE	10	ND	5	
G7	30-Jun-97	SG	TCE	30	ND	5	
G7	30-Jun-97	SG	TCE	35	ND	5	
G7	30-Jun-97	GW	TCE	15	ND	5	
G7	30-Jun-97	GW	TCA	15	0.3	5	J
G8	24-Jun-97	SG	TCE	5	ND	5	
G8	24-Jun-97	SG	TCE	10	ND	5	
G8	24-Jun-97	SG	TCE	15	ND	5	
G8	24-Jun-97	SG	TCE	35	ND	5	
G8	24-Jun-97	GW	No Water Detected				
G9	24-Jun-97	SG	TCE	5	ND	5	
G9	24-Jun-97	SG	TCE	10	ND	5	
G9	24-Jun-97	SG	TCE	15	ND	5	
G9	24-Jun-97	SG	TCE	20	ND	5	
G9	24-Jun-97	SG	TCE	25	ND	5	
G9	24-Jun-97	SG	TCE	30	ND	5	
G9	24-Jun-97	GW	No Water Detected				
H1		SG	Obstructed by Trees and Grade				
H1		GW	Obstructed by Trees and Grade				
H10	26-Jun-97	SG	TCE	5	ND	5	
H10	26-Jun-97	SG	TCE	10	ND	5	
H10	26-Jun-97	SG	TCE	15	ND	5	
H10	26-Jun-97	SG	TCE	20	ND	5	
H10	26-Jun-97	GW	No Water Detected				
H2		SG	Obstructed by Trees and Grade				
H2		GW	Obstructed by Trees and Grade				
H3	02-Jul-97	SG	TCE	5	ND	5	
H3	02-Jul-97	SG	TCE	10	ND	5	
H3	02-Jul-97	SG	TCE	15	ND	5	
H3	02-Jul-97	SG	TCE	20	ND	5	
H3	02-Jul-97	SG	TCE	25	ND	5	

Grid Location	Sample Date	Sample Type	Parameter	Feet Below Ground Surface	Concentration (ppb)	Det. Limit (ppb)	Qualifier
I10	30-Jun-97	SG	TCE	20	ND	5	
I10	30-Jun-97	SG	TCE	25	ND	5	
I10	30-Jun-97	SG	TCE	30	ND	5	
I10	30-Jun-97	SG	TCE	35	ND	5	
I10	30-Jun-97	SG	TCE	40	ND	5	
I10	30-Jun-97	SG	TCE	54	ND	5	
I10	30-Jun-97	GW	TCE	10	ND	5	
I11	14-Jul-97	SG	TCE	5	ND	5	
I11	14-Jul-97	SG	TCE	15	ND	5	
I11	14-Jul-97	SG	TCE	20	ND	5	
I11	14-Jul-97	SG	TCE	25	ND	5	
I11	14-Jul-97	SG	TCE	30	ND	5	
I11	14-Jul-97	SG	TCE	35	ND	5	
I11	14-Jul-97	GW	No Water Detected				
I2		SG	Obstructed by Trees and Grade				
I2		GW	Obstructed by Trees and Grade				
I3	10-Jul-97	SG	TCE	5	ND	5	
I3	10-Jul-97	SG	TCE	10	ND	5	
I3	10-Jul-97	SG	TCE	15	ND	5	
I3	10-Jul-97	SG	TCE	20	ND	5	
I3	10-Jul-97	SG	TCE	25	ND	5	
I3	10-Jul-97	GW	No Water Detected				
I4	02-Jul-97	SG	TCE	5	ND	5	
I4	02-Jul-97	SG	TCE	10	ND	5	
I4	02-Jul-97	GW	No Water Detected				
I5	01-Jul-97	SG	TCE	5	ND	5	
I5	01-Jul-97	SG	TCE	10	ND	5	
I5	01-Jul-97	SG	TCE	20	ND	5	
I5	01-Jul-97	SG	TCE	35	ND	5	
I5	01-Jul-97	GW	No Water Detected				
I6	01-Jul-97	SG	TCE	5	ND	5	
I6	01-Jul-97	SG	TCE	10	ND	5	
I6	01-Jul-97	SG	TCE	15	ND	5	

Grid Location	Sample Date	Sample Type	Parameter	Feet Below Ground Surface	Concentration (ppb)	Det. Limit (ppb)	Qualifier
J3	09-Jul-97	SG	TCE	20	ND	5	
J3	09-Jul-97	GW	No Water Detected				
J4	02-Jul-97	SG	TCE	5	ND	5	
J4	02-Jul-97	SG	TCE	10	ND	5	
J4	02-Jul-97	SG	TCA	10	7	5	
J4	02-Jul-97	SG	TCE	15	ND	5	
J4	02-Jul-97	SG	TCA	15	10.63	5	
J4	02-Jul-97	SG	TCE	20	ND	5	
J4	02-Jul-97	SG	TCA	20	7.7	5	
J4	02-Jul-97	SG	TCE	25	ND	5	
J4	02-Jul-97	SG	TCA	25	9.02	5	
J4	02-Jul-97	SG	TCE	28.6	ND	5	
J4	02-Jul-97	SG	TCA	28.6	6.23	5	
J4	02-Jul-97	GW	No Water Detected				
J4 - Dup. Sample	02-Jul-97	SG	TCE	25	ND	5	
J4 - Dup. Sample	02-Jul-97	SG	TCA	25	9.44	5	
J5	23-Jun-97	SG	TCE	35	ND	5	
J5	23-Jun-97	SG	TCE	38	ND	5	
J5	23-Jun-97	GW	No Water Detected				
J5 - Conf. Sample Loc	23-Jun-97	SG	TCE	5	ND	5	
J5 - Conf. Sample Loc	23-Jun-97	SG	TCE	15	ND	5	
J5 - Conf. Sample Loc	23-Jun-97	SG	TCE	25	ND	5	
J6	23-Jun-97	SG	TCE	5	ND	5	
J6	23-Jun-97	SG	TCE	35	ND	5	
J6	23-Jun-97	SG	TCE	45	ND	5	
J6	23-Jun-97	GW	TCE	23.2	ND	5	
J7	19-Jun-97	SG	TCE	5	ND	5	
J7	19-Jun-97	GW	No Water Detected				
J8	19-Jun-97	SG	TCE	5	ND	5	
J8	19-Jun-97	SG	TCE	10	ND	5	
J8	19-Jun-97	SG	TCE	15	ND	5	
J8	19-Jun-97	SG	TCE	20	ND	5	
J8	19-Jun-97	SG	TCE	25	ND	5	

Grid Location	Sample Date	Sample Type	Parameter	Feet Below Ground Surface	Concentration (ppb)	Det. Limit (ppb)	Qualifier
K6	16-Jun-97	GW	No Water Detected				
K7	23-Jun-97	SG	TCE	5	ND	5	
K7	23-Jun-97	SG	TCE	10	ND	5	
K7	23-Jun-97	SG	TCE	25	ND	5	
K7	23-Jun-97	SG	TCE	28.4	ND	5	
K7	23-Jun-97	GW	No Water Detected				
K8	20-Jun-97	SG	TCE	15	ND	5	
K8	20-Jun-97	SG	TCE	20	ND	5	
K8	20-Jun-97	SG	TCE	25	ND	5	
K8	20-Jun-97	GW	No Water Detected				
K9	19-Jun-97	SG	TCE	5	ND	5	
K9	19-Jun-97	SG	TCE	15	ND	5	
K9	19-Jun-97	GW	No Water Detected				
L10	23-Jun-97	SG	TCE	5	ND	5	
L10	23-Jun-97	SG	TCE	10	ND	5	
L10	23-Jun-97	GW	No Water Detected				
L10 - Conf. Sample Lo	23-Jun-97	SG	TCE	20	ND	5	
L10 - Conf. Sample Lo	23-Jun-97	SG	TCE	30	ND	5	
L11	19-Jun-97	SG	TCE	5	ND	5	
L11	19-Jun-97	SG	TCE	10	ND	5	
L11	19-Jun-97	SG	TCE	15	ND	5	
L11	19-Jun-97	SG	TCE	20	ND	5	
L11	19-Jun-97	SG	TCE	25	ND	5	
L11	19-Jun-97	GW	No Water Detected				
L2		SG	Obstructed by Trees and Grade			5	J
L2		GW	Obstructed by Trees and Grade			5	J
L3	09-Jul-97	SG	No Soil Gas Detected				
L3	09-Jul-97	GW	No Water Detected				
L4	24-Jun-97	SG	TCE	5	ND	5	
L4	24-Jun-97	SG	TCE	10	ND	5	
L4	24-Jun-97	SG	TCE	22	ND	5	
L4	24-Jun-97	GW	No Water Detected				
L5	13-Jun-97	SG	TCE	5	ND	5	

Grid Location	Sample Date	Sample Type	Parameter	Feet Below Ground Surface	Concentration (ppb)	Det. Limit (ppb)	Qualifier
M2		SG	Obstructed by Trees and Grade				
M2		GW	Obstructed by Trees and Grade				
M3	08-Jul-97	SG	TCE	5	ND	5	
M3	08-Jul-97	SG	TCE	10	0.47	5	J
M3	08-Jul-97	SG	TCE	15	1.31	5	J
M3	08-Jul-97	SG	TCA	15	12.86	5	
M3	08-Jul-97	SG	TCE	20	1.23	5	J
M3	08-Jul-97	SG	TCA	20	13.76	5	
M3	08-Jul-97	SG	TCE	23	1.02	5	J
M3	08-Jul-97	SG	TCA	23	12.91	5	
M3	08-Jul-97	GW	No Water Detected				
M3 - Conf. Sample Lo	08-Jul-97	SG	TCE	5	ND	5	
M3 - Conf. Sample Lo	08-Jul-97	SG	TCE	10	ND	5	
M3 - Conf. Sample Lo	08-Jul-97	SG	TCE	15	ND	5	
M3 - Conf. Sample Lo	08-Jul-97	SG	TCE	20	ND	5	
M3 - Conf. Sample Lo	08-Jul-97	SG	TCA	20	11.3	5	
M4	24-Jun-97	SG	TCE	5	ND	5	
M4	24-Jun-97	SG	TCE	15	ND	5	
M4	24-Jun-97	SG	TCE	20	ND	5	
M4	24-Jun-97	SG	TCE	22	ND	5	
M4	24-Jun-97	GW	No Water Detected				
M5	17-Jun-97	SG	TCE	5	ND	5	
M5	17-Jun-97	SG	TCE	10	ND	5	
M5	17-Jun-97	SG	TCE	25	ND	5	
M5	17-Jun-97	SG	TCE	30	ND	5	
M5	17-Jun-97	SG	TCE	35	ND	5	
M5	17-Jun-97	GW	No Water Detected				
M6	10-Jun-97	SG	TCE	5	ND	5	
M6	10-Jun-97	SG	TCE	10	ND	5	
M6	10-Jun-97	SG	TCE	15	ND	5	
M6	10-Jun-97	GW	No Water Detected				
M7	12-Jun-97	SG	TCE	5	ND	5	
M7	12-Jun-97	SG	TCE	10	ND	5	

Grid Location	Sample Date	Sample Type	Parameter	Feet Below Ground Surface	Concentration (ppb)	Det. Limit (ppb)	Qualifier
N2	04-Aug-97	SG	TCE	5	ND	5	
N2	04-Aug-97	SG	TCE	10	ND	5	
N2	04-Aug-97	SG	TCE	15	ND	5	
N2	04-Aug-97	SG	TCE	20	ND	5	
N2	04-Aug-97	SG	TCE	25	ND	5	
N2	04-Aug-97	SG	TCE	30	ND	5	
N2	04-Aug-97	SG	TCE	30.8	ND	5	
N2	04-Aug-97	GW	No Water Detected				
N3	08-Jul-97	SG	TCE	5	0.56	5	J
N3	08-Jul-97	SG	TCE	10	0.78	5	J
N3	08-Jul-97	SG	TCE	15	1.02	5	J
N3	08-Jul-97	SG	TCE	20	1.09	5	J
N3	08-Jul-97	SG	TCE	25	1.83	5	J
N3	08-Jul-97	SG	TCE	30	0.19	5	J
N3	08-Jul-97	GW	No Water Detected				
N4	07-Jul-97	SG	TCE	5	ND	5	
N4	07-Jul-97	SG	TCE	25	ND	5	
N4	07-Jul-97	SG	TCE	28.7	ND	5	
N4	07-Jul-97	GW	No Water Detected				
N5	01-Jul-97	SG	TCE	7	ND	5	
N5	01-Jul-97	SG	TCA	7	2.39	5	J
N5	01-Jul-97	SG	TCE	12	ND	5	
N5	01-Jul-97	SG	TCA	12	2.86	5	J
N5	01-Jul-97	SG	TCA	17	4.69	5	J
N5	01-Jul-97	SG	TCE	17	ND	5	
N5	01-Jul-97	SG	TCE	22	ND	5	
N5	01-Jul-97	SG	TCA	22	5.02	5	
N5	01-Jul-97	SG	TCE	27	ND	5	
N5	01-Jul-97	SG	TCA	27	5.1	5	
N5	01-Jul-97	SG	TCE	32	ND	5	
N5	01-Jul-97	SG	TCA	32	7.89	5	
N5	01-Jul-97	SG	TCE	37	ND	5	
N5	01-Jul-97	SG	TCA	37	7.81	5	

Grid Location	Sample Date	Sample Type	Parameter	Feet Below Ground Surface	Concentration (ppb)	Det. Limit (ppb)	Qualifier
O2	31-Jul-97	SG	TCE	15	10.8	5	
O2	31-Jul-97	SG	TCA	15	0.3	5	J
O2	31-Jul-97	SG	TCE	20	9.8	5	
O2	31-Jul-97	SG	TCA	20	0.7	5	J
O2	31-Jul-97	SG	TCE	25	18.8	5	
O2	31-Jul-97	SG	TCA	25	0.6	5	J
O2	31-Jul-97	SG	TCE	28.7	ND	5	
O2	31-Jul-97	GW	No Water Detected				
O3	07-Jul-97	SG	TCE	5	283.77	5	
O3	07-Jul-97	SG	TCE	10	329.92	5	
O3	07-Jul-97	SG	TCE	15	328.83	5	
O3	07-Jul-97	SG	TCE	20	367.72	5	
O3	07-Jul-97	SG	TCE	25	308.24	5	
O3	07-Jul-97	GW	No Water Detected				
O3 - Conf. Sample Lo	07-Jul-97	SG	TCE	5	18.98	5	
O3 - Conf. Sample Lo	07-Jul-97	SG	TCE	10	1.79	5	J
O3 - Conf. Sample Lo	07-Jul-97	SG	TCE	20	96.61	5	
O3 - Conf. Sample Lo	07-Jul-97	SG	TCE	25	158.88	5	
O4	03-Jul-97	SG	TCE	5	29.6	5	
O4	03-Jul-97	SG	TCA	5	2.6	5	J
O4	03-Jul-97	SG	TCE	10	13.02	5	
O4	03-Jul-97	SG	TCA	10	2.4	5	J
O4	03-Jul-97	SG	TCE	15	19.9	5	
O4	03-Jul-97	SG	TCA	15	2	5	J
O4	03-Jul-97	SG	TCE	20	24.5	5	
O4	03-Jul-97	SG	TCA	20	4.39	5	J
O4	03-Jul-97	SG	TCE	29	8.98	5	
O4	03-Jul-97	SG	TCA	29	1.4	5	J
O4	03-Jul-97	GW	No Water Detected				
O5	09-Jun-97	SG	TCE	5	6.4	5	
O5	09-Jun-97	SG	TCE	10	ND	5	
O5	09-Jun-97	GW	No Water Detected				
O5 - Dup. Sample	09-Jun-97	SG	TCE	5	7.6	5	

Grid Location	Sample Date	Sample Type	Parameter	Feet Below Ground Surface	Concentration (ppb)	Det. Limit (ppb)	Qualifier
P3		GW	Obstructed by Trees and Grade				
P4	07-Jul-97	SG	TCE	5	22.96	5	
P4	07-Jul-97	SG	TCE	10	26.1	5	
P4	07-Jul-97	SG	TCE	15	36	5	
P4	07-Jul-97	SG	TCE	20	32.84	5	
P4	07-Jul-97	SG	TCE	25	31.19	5	
P4	07-Jul-97	SG	TCE	30	23.12	5	
P4	07-Jul-97	GW	No Water Detected				
P5	04-Jun-97	SG	TCE	5	ND	5	
P5	04-Jun-97	SG	TCE	10	ND	5	
P5	04-Jun-97	SG	TCE	15	ND	5	
P5	04-Jun-97	SG	TCE	20	ND	5	
P5	04-Jun-97	SG	PCE	20	1	5	J
P5	04-Jun-97	GW	No Water Detected				
P6	05-Jun-97	SG	TCE	5	ND	5	
P6	05-Jun-97	SG	TCE	10	ND	5	
P6	05-Jun-97	SG	TCE	15	ND	5	
P6	05-Jun-97	SG	TCE	20	ND	5	
P6	05-Jun-97	SG	TCE	25	ND	5	
P6	05-Jun-97	GW	TCE	20	ND	5	
P6	05-Jun-97	GW	TCE	25	ND	5	
P6	05-Jun-97	GW	TCE	30.6	ND	5	
P7	10-Jul-97	SG	No Soil Gas Detected				
P7	10-Jul-97	GW	TCE	10	ND	5	
P7	10-Jul-97	GW	TCE	15	ND	5	
P7	10-Jul-97	GW	TCA	15	0.02	5	J
P7	10-Jul-97	GW	TCE	22.9	ND	5	
P7	10-Jul-97	GW	TCA	22.9	0.03	5	J
P8	12-Jun-97	SG	TCE	5	ND	5	
P8	12-Jun-97	GW	TCE	5	1.4	5	J
P8	12-Jun-97	GW	TCE	10.4	1.3	5	J
P9	30-Jul-97	SG	No Soil Gas Detected				
P9	30-Jul-97	GW	TCE	13.3	ND	5	

Grid Location	Sample Date	Sample Type	Parameter	Feet Below Ground Surface	Concentration (ppb)	Det. Limit (ppb)	Qualifier
R10	29-Jul-97	GW	TCE	21.9	ND	5	
R4	24-Jul-97	SG	TCE	5	ND	5	
R4	24-Jul-97	SG	TCE	15	ND	5	
R4	24-Jul-97	SG	TCE	25	ND	5	
R4	24-Jul-97	SG	TCE	30	0.9	5	J
R4	24-Jul-97	SG	TCE	30.9	ND	5	
R4	24-Jul-97	SG	TCA	30.9	0.8	5	J
R4	24-Jul-97	GW	No Water Detected				
R5	24-Jul-97	SG	TCE	5	ND	5	
R5	24-Jul-97	SG	TCE	10	ND	5	
R5	24-Jul-97	SG	TCE	25	ND	5	
R5	24-Jul-97	GW	TCE	30	ND	5	
R5	24-Jul-97	GW	TCE	30	ND	5	
R6	25-Jul-97	SG	TCE	16.3	ND	5	
R6	25-Jul-97	GW	No Water Detected				
R7	25-Jul-97	SG	TCE	5	ND	5	
R7	25-Jul-97	GW	TCE	12.6	ND	5	
R8	28-Jul-97	SG	TCE	10	ND	5	
R8	28-Jul-97	GW	TCE	16.4	ND	5	
R9	28-Jul-97	SG	TCE	5	ND	5	
R9	28-Jul-97	SG	TCE	10	ND	5	
R9	28-Jul-97	SG	TCE	15	ND	5	
R9	28-Jul-97	GW	No Water Detected				
S10	10-Aug-97	SG	TCE	5	ND	5	
S10	10-Aug-97	SG	TCE	10	ND	5	
S10	10-Aug-97	GW	No Water Detected				
S8	30-Jul-97	SG	TCE	5	ND	5	
S8	30-Jul-97	SG	TCE	10	ND	5	
S8	30-Jul-97	GW	TCE	13.2	ND	5	
S9	11-Aug-97	SG	TCE	5	ND	5	
S9	11-Aug-97	SG	TCE	10	ND	5	
S9	11-Aug-97	SG	TCE	14.5	ND	5	
S9	11-Aug-97	GW	No Water Detected				

APPENDIX B

Bulk Soil Confirmation Results

		TCE Bulk Soil Confirmation Results		
Grid Location	Sample date	Sample Type	Feet Below Ground Surface	Concentration (ug/kg)
I5	8/12/97	soil	20	ND
I8	8/12/97	soil	18	ND
J6	8/13/97	soil	15	ND
K4	8/12/97	soil	15	ND
L10	8/12/97	soil	10	ND
L8	8/12/97	soil	15	ND
M3	8/6/97	soil	15	1.4
N2	8/5/97	soil	10	ND
O2	8/5/97	soil	15	56
O2	8/5/97	soil	25	8.4
O3	8/6/97	soil	15	880
O3	8/6/97	soil	25	89
O4	8/6/97	soil	15	4.5
P2	8/5/97	soil	10	1.5
P4	8/6/97	soil	15	ND
Q4	8/6/97	soil	20	2.3

APPENDIX C

Soil Screening Calculations

APPLICATION OF STANDARDIZED MOUND SOIL SCREENING GUIDANCE EQUATIONS FOR DETERMINING A POTENTIAL CONTAMINANT SOURCE AREA TO THE BURRIED VALLEY AQUIFER

INTRODUCTION

In the summer of 1997, Mound initiated a "Limited Field Investigation" to investigate the nature and extent of elevated volatile organic compounds (VOCs) in several groundwater monitoring wells. Results indicate that within the study area there is not a widespread soils VOC contamination problem. The data do however indicate an isolated area (in the immediate vicinity of monitoring well 0312) of soil contaminated with trichloroethene. Soil gas samples were collected at concentrations of approximately 300 ug/l. Bulk soil samples were also taken from the area as confirmation samples. These samples were sent to RECRA labs and analyzed for total soil concentration in accordance with Method SW-846 8021. Results show localized bulk soil contamination concentrations up to approximately 900 ug/kg, (refer to the Limited Field Investigation – VOCs in Monitoring Wells report, 4/98, for maps showing the distribution of soil gas and soil confirmation sample results).

The State of Ohio Environmental Protection Agency requested that DOE utilize the "soil screening guidance equations" to evaluate the potential for these TCE contaminated soils to serve as a significant source term of TCE to the Buried Valley Aquifer (BVA) groundwater system. Details of the Standardized Equations based upon EPA Soil Screening Guidance are found in Attachment D4, Volume II of *Potential Release Site packages, Reading and Understanding,* PRELIMINARY, August , 1996.

RESULTS

The soil screening guidance equations were applied to the soils overlying the bedrock aquifer system in the immediate vicinity of monitoring well 0312. There are essentially 4 input parameters in the model that define the physical setting. Those parameters are: 1) source length parallel to groundwater flow, 2) aquifer thickness, 3) hydraulic conductivity, and 4) hydraulic gradient at the source.

For model runs, the parameters were allowed to vary as shown below:

Source length parallel to groundwater flow was allowed to vary between 15 and 50 meters, with 50 representing the most conservative case.

Aquifer thickness was allowed to vary between 5 and 15 meters, with 5 representing the most conservative case.

Hydraulic conductivity was varied between 50 and 100 meters/year, with 50 being the most conservative value.

Hydraulic gradient was varied between 0.08 and 0.14 (essentially the slope of the bedrock surface) with 0.08 representing the most conservative gradient.

All other parameters, with the exception of horizontal distance to the receptor, were either chemical specific or were previously defined as site specific values. Horizontal distance to the receptor was taken as the distance between well 0312 and the boundary of the BVA (defined as the 685 foot elevation contour).

The results of the modeling indicate that even when utilizing the least conservative set of input parameters, the model cannot preclude the possibility that the contaminated soils are a source area for TCE groundwater concentrations in excess of 5 ppb at the BVA boundary. Model results indicate that the least conservative set of input parameters yield a TCE soil screening level of 690 ug/kg. This number is below the maximum value of 880 ug/kg for the soil confirmation sample.

In summary, the soil screening model indicates that the soils in the vicinity of monitoring well 0312, contaminated with TCE at 880 ug/kg (highest laboratory confirmed concentration of a single sample), could serve as a source of groundwater contamination, with dissolved TCE concentration in excess of 5 ppb, to the BVA groundwater system.

Estimate of Hypothetical Soil Water Concentration Resulting from a Total TCE Soil Concentration of 880 µg/kg

$$C_w = \frac{C_t \rho_b}{K_d \rho_b + n_w + H_c n_a}$$

From Feenstra et al. (1991)

C(t) = total soil concentration (mg/kg)
P(b) = dry bulk density of soil
N(w) = water filled porosity (volume fraction)
N(a) = air filled porosity (volume fraction)
K(d) = partition coefficient for TCE
H(c) = Dimensionless form of Henry's Law Constant for TCE
C(w) = calculated porewater concentration (mg/L)

For Mound Soils adjacent to Monitoring Well 0312:

C(t) = 880 ug/kg TCE
P(b) = 1.6 kg/L
N(w) = 0.15
N(a) = 0.28
H(c) = 0.435 (TCE)
K(d) = 2.24 L/kg (TCE)

C(w) = {(880 ug/kg)(1.6 kg/L) / [(2.24 L/kg)(1.6 kg/L) + 0.15 + (0.435)(0.28)] }

C(w) = 142 ppb

Reference: Feenstra, S., D.M. Mackay and J.A. Cherry, 1991. A Method for Assessing the Presence of Residual NAPL Based on Organic Chemical Concentrations in Soil Samples. Ground Water Monitoring Review, Vol. 11, No. 2, pp. 128 - 136

APPENDIX D

Potential Groundwater Concentration Calculations

IOC

TO: Brian Nickel, OFFO/SWDO

FROM: Matthew Justice through Rich Bendula CPG, DDAGW/SWDO

SUBJECT: One Dimensional Solute Transport Model to Evaluate the submitted Limited Field Investigation: VOCs in Monitoring Wells, (draft) April, 1998

PROJECT: 08-03-98-01-4-600

DATE: August 28, 1998

INTRODUCTION

During an August 6th conference between OEPA, USEPA, US DOE Mound, and Babcock and Wilcox, the results of the soil screening model simulation were discussed. The simulation run by B&W was used to back calculate from the BVA, an acceptable soil concentration for the presumed source area. An acceptable soil concentration was defined as one which would not cause ground water at a reception point to exceed MCLs. A representative bulk soil concentration for TCE at the location of node O3 (Limited Field Investigation), was found to exceed the calculated soil screening limit. In order to estimate a ground water concentration at the BVA, the OEPA/DDAGW used a one dimensional analytical fate and transport model created by Domenico and Robbins, 1985. Various scenarios of the model were run. The results support the findings of the soil screening model. The model results indicate that steady state TCE concentrations of at least 83 ppb will be encountered at the BVA down gradient of the source area.

CONCEPTUAL MODEL

The source area lies on a intensely fractured, bedrock high on the western slope of the Main Hill. Approximately 25 feet of unsaturated soil overlay a shale, limestone fractured carapace. The Limited Field Investigation, which conducted a closely spaced soil gas survey in the unsaturated soil, defined a small 50 foot wide area, centered around core O3, with elevated TCE soil gas. The survey indicated elevated TCE, down to bedrock at 25 feet. Babcock and Wilcox used the highest bulk soil concentration from core O3, 888 ppb, to compute a theoretical leachate concentration of 143 ppb. The conceptual model assumes that this leachate will infiltrate down into the saturated bedrock. Once in the bedrock, the ground water flows down gradient to the BVA. Observations of bedrock exposures at Mound indicate that the bedrock behaves similar to a porous media.

DOMENICO & ROBBINS MODEL

Ohio EPA used the theoretical leachate value as the initial ground water concentration to predict a final concentration at the BVA reception point fifty meters down gradient. The Domenico &

Robbins Model can be referred to as a plug flow model with both longitudinal and transverse dispersion

$$C = (C_0/2) * erfc((x - vt) / 2(disp_x vt)^{1/2}) * erf(Y / (4(disp_y x)^{1/2})) * erf(Z / (2(disp_z x)^{1/2}))$$

where

C	final concentration (ppb)
C_0	initial concentration (ppb)
t	time (days)
x	distance to the receptor (meters)
v	average linear velocity of the contaminant (meters/day)
$disp$	dispersivity (meters)
Y	width of the source area (meters)
Z	source area depth (meters)
$erfc$	complementary error function
erf	error function

Once the arguments for the error functions and complementary error function are found, the solution values may be found on page 637 of Domenico and Schwarz.

Reference: Domenico, P. A et al, Physical and Chemical Hydrogeology, 1990

Just as the soil screening model, this model treats the bedrock is a porous, homogenous, continuum with a continuous planar source area feeding leachate to the water table. It predicts concentration values for various times along a one-dimensional flow path with a constant velocity.

Because the model incorporates longitudinal and transverse spreading of the contaminant, the dimensions of the source have to be estimated. The results of the soil gas survey were used to estimate the dimensions of the source area. Because the model assumes a nonreacting species, the only attenuation processes incorporated in the model are multi-dimensional dispersion.

Required Input Parameters

Because the overlying soil is unsaturated, the model input parametrs selected were used to simulate flow through the bedrock aquifer. OEPA used the most conservative values for aquifer input parameters. Other than dispersivity, and source area dimensions, the values are the same as those selected by B&W for the soil screening model.

Hydraulic Conductivity ranges from 50 to 100 m/yr, OEPA used the conservative value of 50 m/yr or **0.14 m/day**.

Hydraulic Gradient was taken from the average slope of the bedrock surface between the source area and reception point as **0.08**.

Saturated Porosity used was that from the soil screening model **0.15.**

Average Linear Velocity was calculated to be **0.07 m/day**.

Longitudinal Dispersivity, $disp_x$, values ranging from **0.1 to 2 meters** were used (Domenico & Schwarz, p 374)

Transverse Dispersivities, $disp_y$ & $disp_z$ were taken to be one order of magnitude less than the longitudinal dispersivity (Domenico & Schwarz, p 374)

Source Size depth dimension twenty-five feet or **8.2 m**.

Source Size width fifty feet or **16 m**.

Optional Input Parameters

In order to examine the effect of retardation on transport, a retardation factor was calculated using input parameters from the soil screening model. The retardation factor was divided into the average linear velocity determine a retarded contaminant velocity for TCE.

Dry Bulk Density value was that used in the soil screening model of **1.5 Kg/L**.

Koc **165.69**

Fraction of Organic Carbon foc **0.02**

Distribution Coefficient **3.31 L/Kg**

Retardation Factor **34.1**

Contaminant Velocity **0.002 m/day**

RESULTS

Four simulations of the Domenico and Robbins Model were run to examine the effects of multi-dimensional dispersion, and retardation.

According to Domenico and Schwarz, the range of field values for longitudinal dispersivity is 0.1 to 2.0 meters. Two model simulations were run to encompass this range. Figure One shows that if a longitudinal dispersivity of 2.0 meters is used, with transverse dispersivities of 0.2 meters, the

MCL of five ppb for TCE will be reached in 241 days. After the initial dispersion zone passes through, the steady state portion of the plume, with a concentration of 83 ppb will reach the reception point in 250 days.

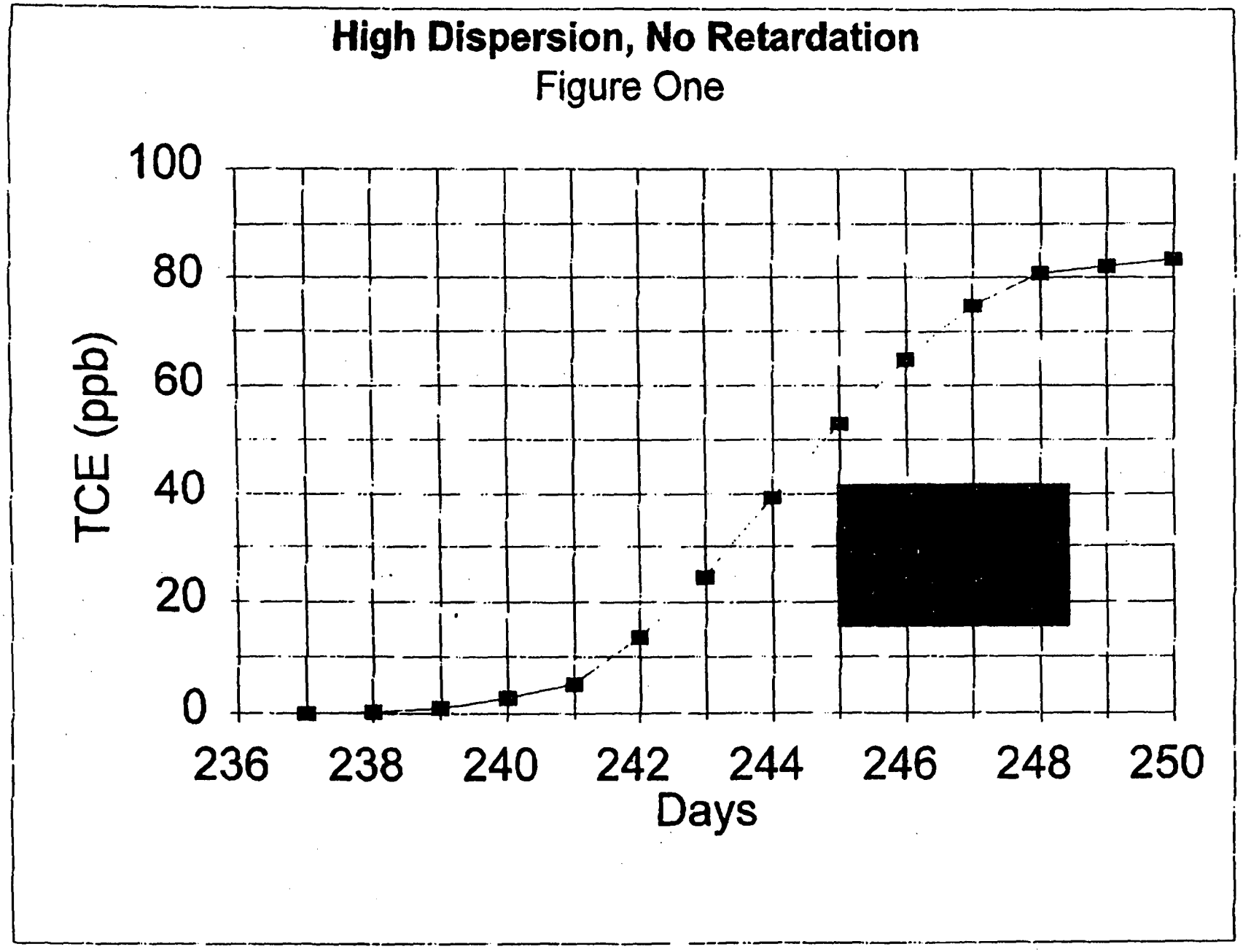
Figure Two illustrates the effect of using the low end of the acceptable longitudinal dispersivity range, 0.1 meters. Longitudinal dispersion is not an attenuating factor because the source is modeled as continuous. Therefore attenuation is dependent upon the transverse dispersivities. In this case the transverse dispersivities are too low to induce attenuation. Therefore, the steady state portion of the plume is not attenuated, but remains at the initial concentration of 143 ppb. This is not representative of actual conditions.

Figures Three and Four examine the effect of retardation on the cases illustrated by Figure One and Two respectively. As shown, retardation has no effect on the concentration of TCE. Instead the effect is to reduce the travel time significantly. However, simulating retardation for the case of water migrating through weathered rock is probably not applicable. Retardation is proportional to the amount of available organic carbon. Although the rock does contain organic carbon, this carbon is most likely bound within the rock matrix. In addition, the rock has a low surface area, compared to an unconsolidated porous media. Without a significant surface area for sorption to take place, the effect of retardation would be greatly reduced.

CONCLUSIONS

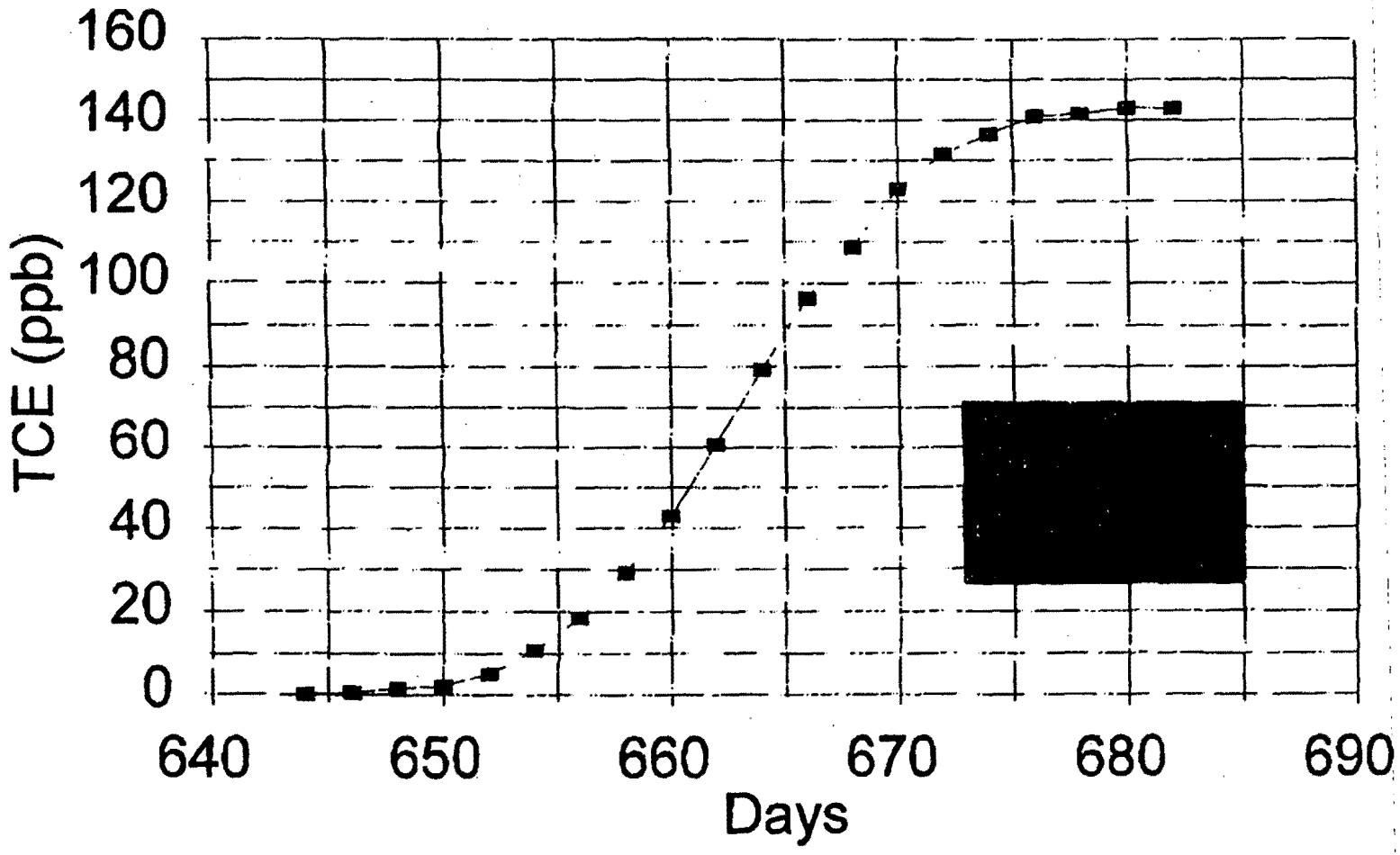
The best approximation of TCE concentrations reaching the BVA reception point can be estimated from the results shown in Figures One and Two. These simulations exclude retardation but encompass the acceptable range of dispersivity. Therefore the results indicate that steady state concentrations of 85 ppb or greater will reach the reception point between 250 to 680 days.

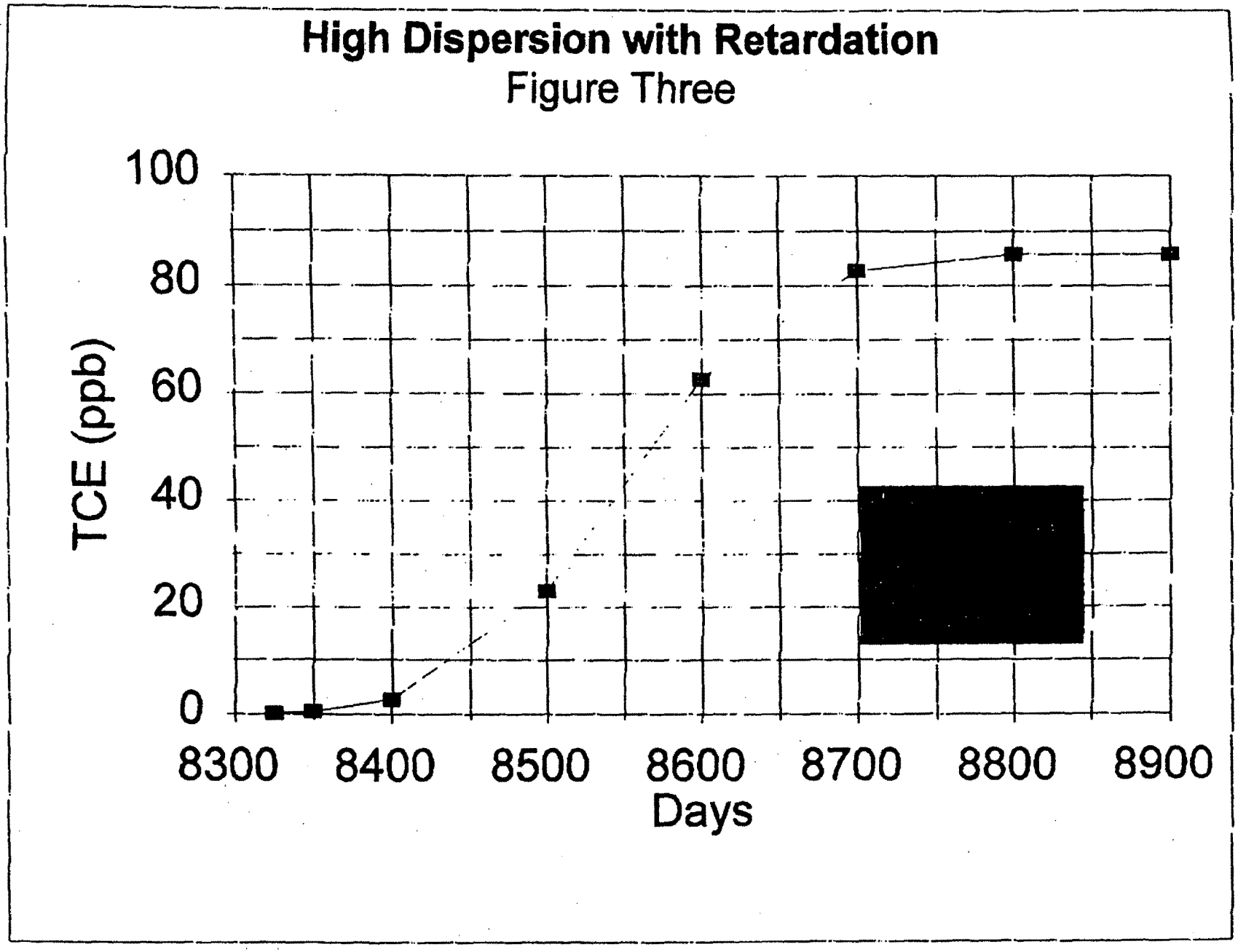
cc:
Jeff Patzke CO/DDAGW
Lisa Anderson SWDO/OFFO
Kathy Lee Fox SWDO/OFFO


High Dispersion, No Retardation
Figure One
TCE (ppb)
100
80
60
40
20
0
236
238
240
242
244
246
248
250
Days

Low Dispersion, No Retardation

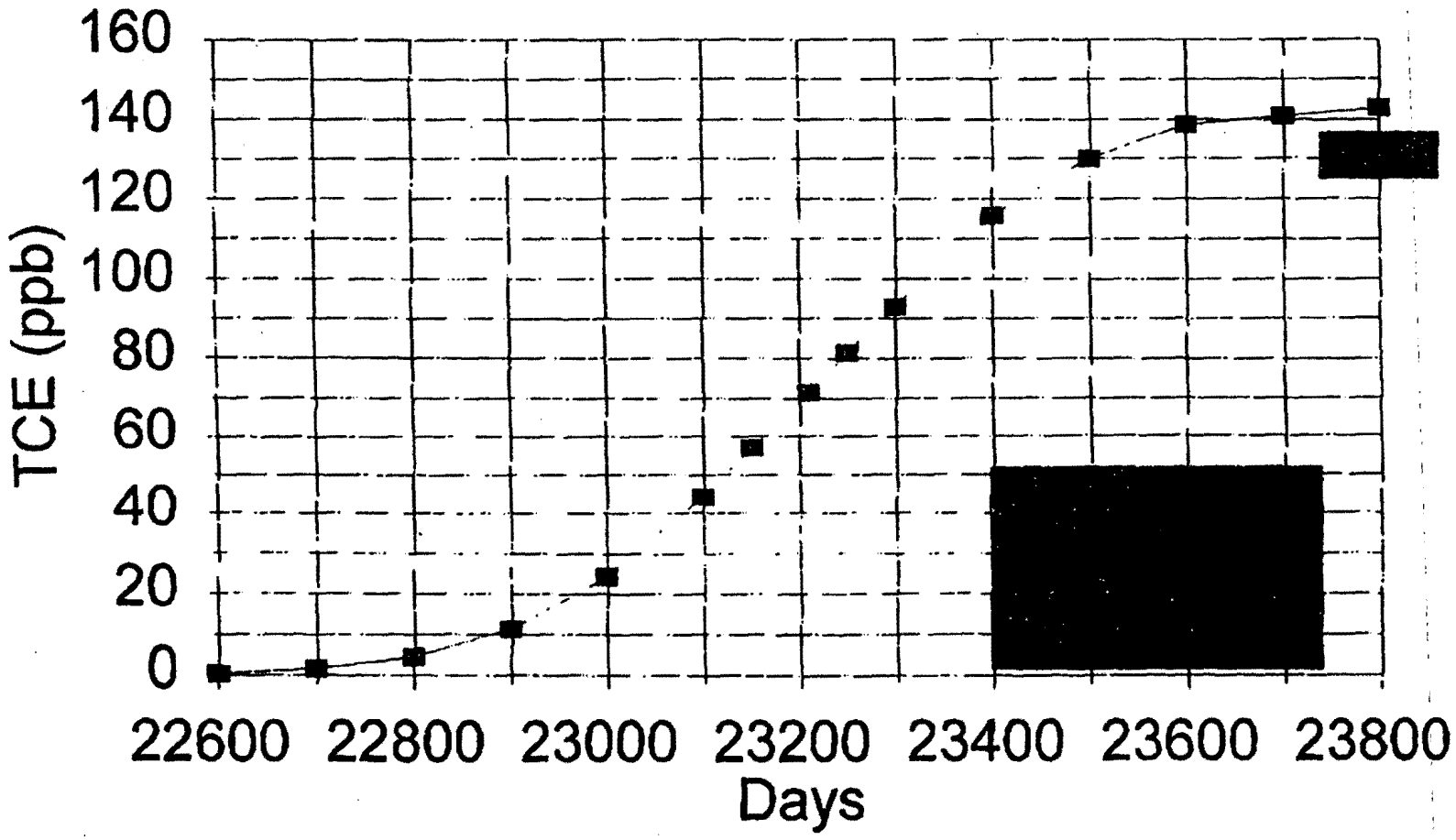
Figure Two




High Dispersion with Retardation
Figure Three
TCE (ppb)
100
80
60
40
20
0
8300
8400
8500
8600
8700
8800
8900
Days

Low Dispersion with Retardation

Figure Four



APPENDIX E

Estimated Flux of Groundwater into Well 0312

ESTIMATED FLUX OF GROUNDWATER INTO WELL 0312

Assumptions:

- Unsaturated Hydraulic Conductivity = 2×10^{-6} cm/sec[a]
- Hydraulic Gradient = 0.60[b]
- Flow intercepts one half of the circumference of the wellscreen on the upgradient side. Cross-sectional area perpendicular to flow therefore equals:

$$(\pi r) * \textit{thickness of flow zone}$$

- Bottom 3 inches of soil contribute a bulk of the flow to the well along the interface[c]

Well 0312 consistantly holds water at an elevation of 700 ft msl. The bottom of the well lies at elevation approximately 698 ft msl. Therefore the wellbore holds approximately 2 ft of water. This equates to a volume of approximately 1 gallon.

Sampling events at well 0312 indicate that when the wellbore is purged prior to sampling it takes over 24 hours to recharge with a volume sufficient for sampling. The recharge rate in gpm assuming the well is bailed dry and takes 24 hours too fully recovery is 0.0007 gpm.

Estimated flux to well 0312 from seepage along soil/bedrock interface using the assumptions listed above:

$Q = KiA$ where:

Q = groundwater flux into the well
K = unsaturated hydraulic conductivity
I = hydraulic gradient
A = cross-sectional area perpendicular to flow

$Q = (2 \times 10^{-6}\ \text{cm/sec})(0.6)(121\text{cm}^2)$

$Q = 2 \times 10^{-5}$ gpm

[a] Estimated based on 50% of the saturated hydraulic conductivity of a silty sand
[b] Estimated based on the slope of the bedrock surface in the region of 0312. Hydraulic gradient consists of both pressure head gradient and elevation head gradient. Under unsaturated conditions it is assumed that the pressure head does not vary and therefore the only component of gradient that must be considered is that due to elevation difference along the interface.

MOUND

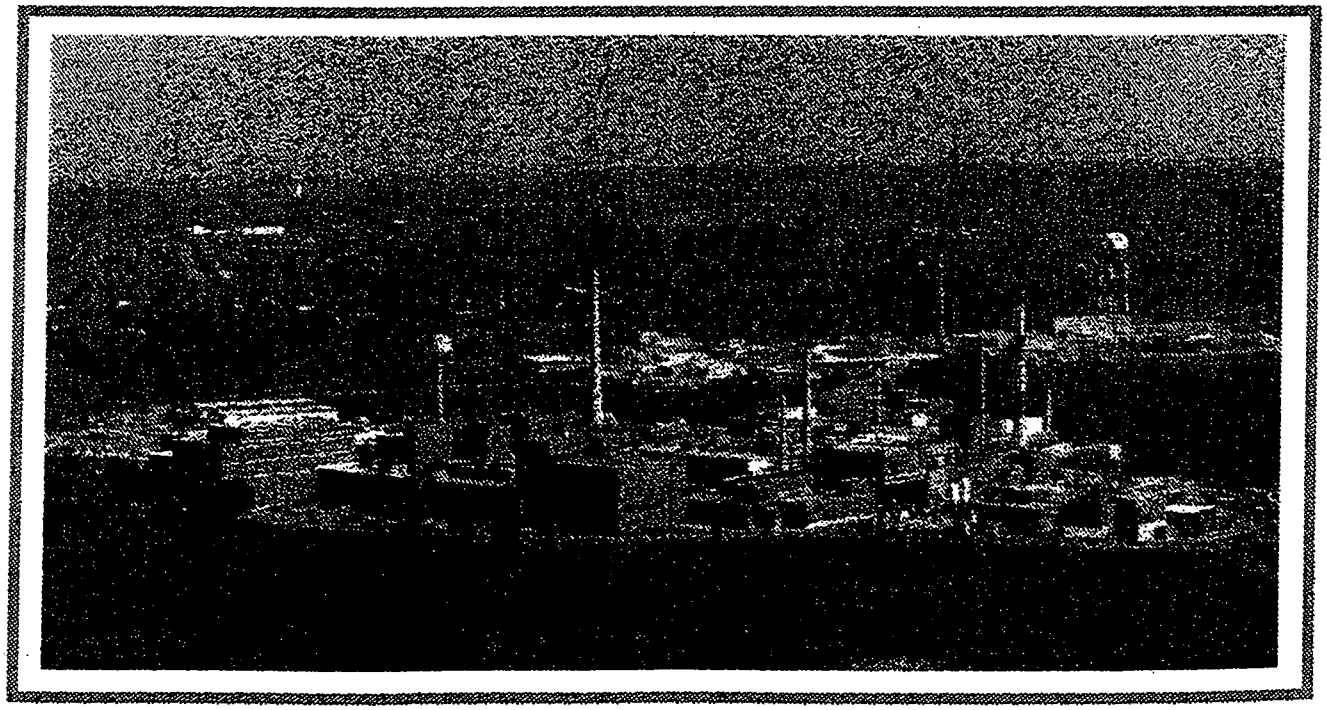
Environmental
Restoration
Program

POTENTIAL RELEASE SITE PACKAGES

Reading and Understanding

VOLUME II

(PRELIMINARY)



August 7, 1996

POTENTIAL RELEASE SITE PACKAGES

READING AND UNDERSTANDING

VOLUME II

(PRELIMINARY)

AUGUST 8, 1996

STANDARDIZED EQUATIONS BASED UPON USEPA SOIL SCREENING GUIDANCE F THE SOIL TO GROUND WATER MIGRATION PATHWAY

A CONSERVATIVE FATE AND TRANSPORT MODEL WHICH IS DEPENDENT UPON SOURCE TERM SIZE, AQUIFER THICKNESS, GRADIENT, AND DISTANCE TO POTENTIAL RECEPTOR TO DETERMINE DILUTION WITHIN GROUNDWATER. NO CHEMICAL ADSORPTION WITHIN THE AQUIFER IS CONSIDERED.

PURPOSE OF SOIL SCREENING LEVELS (SSL) FOR MOUND

The primary purpose of SSLs is to define a level in soil below which no further study or action would be required. Soil screening level calculations are a necessary part of evaluating potential release sites (PRS) to determine whether residual soil contamination poses a threat to ground water. This method is a screening method which will identify any PRS that exceeds a soil screening level concentration. Due to the conservative assumptions, any PRS that does not exceed the SSLs can be considered a non-problem with regard for potential leaching of contaminants into ground water. This method is designed to be a conservative method and is not a full contaminant fate and transport analysis. The assumptions involved are conservative, but site specific. If soil concentrations exceed the calculated levels, additional more detailed site-specific contaminant fate and transport models will be used to determine whether remedial action is needed.

The Mound plant is assumed to continue in an industrial/office park type of land use. Bedrock ground water within the Mound Plant property boundaries will be evaluated to residential standards and MCLs where it migrates across the property boundary towards credible potential receptors or where it may flow into the Buried Valley Aquifer (BVA). It is assumed that there will be no production of bedrock ground water within the site boundaries due to relatively low well specific capacities that would not support industrial activities.

DEVELOPMENT OF SOIL SCREENING LEVELS (SSL) FOR MOUND

The soil screening equations for the migration to the ground water pathway are developed to identify chemical concentrations in soil that have the potential to contaminate ground water. Migration of contaminants from soil to ground water can be thought of as a two-stage process: (1) the release of contaminants in soil leachate and (2) the transport of the contaminant through the underlying soil and aquifer to a receptor well. The equations consider both of these fate and transport mechanisms in developing SSLs that are protective of human health through the migration to ground water pathway. To be used for early PRS evaluation, the methodology needs to be easily applied.

Soil Screening Level (SSL): a chemical concentration in soil below which there is no concern under CERCLA for ingestion, inhalation, and migration to ground water exposure pathways, provided certain conditions are met.

Simple Site-Specific Method: standardized equations to calculate SSLs with easily obtained site-specific data.

Direct ingestion and inhalation of soil volatiles and fugitive dusts:
The Soil Screening framework differs from a site-specific estimate of risk in that the exposure equations and models are run in reverse to back-calculate to an "acceptable level" of contaminant in soil. Toxicity criteria are used to define the acceptable level: a level corresponding to a 10^{-6} risk for carcinogens and a hazard quotient (HQ) of 1 for non-carcinogens. The concept of back-calculating to an acceptable level in soil was presented in RAGS Part B (US EPA, 1991). This is the method utilized to obtain the current Mound Plant PRGs (DOE, 1994).

Migration to ground water:
For the migration to the ground water pathway, SSLs are back-calculated from acceptable ground water concentrations which are maximum contaminant levels (MCLs), or health-based limits (HBLs) calculated at the target risk levels. There are two parts to the ground water migration pathway:

1. Leaching from the soil into the ground water immediately below the source term.

2. Contaminant fate and transport to the potential receptor. Depending upon site-specific conditions the receptor may be considered to be at the source term or at some distance down gradient. The results of the model will be a dilution factor which will be used to modify the back-calculated soil concentrations.

ASSUMPTIONS FOR SOIL TO WATER LEACHING

1. There is no allowance for chemical degradation or volatilization. The source does not decrease in concentration over time. This assumption is conservative, especially for the small sites at Mound.

2. Adsorption is linear with concentration. This is valid for low concentrations (e.g. in the low ppb range) of most chemicals and for halogenated hydrocarbons, polynuclear aromatic hydrocarbons, benzene and chlorinated benzenes at higher concentrations.

3. The soil and pore water concentrations are at equilibrium with respect to adsorption. This assumption is conservative. The concentration in the pore water will be less than predicted by the calculations if equilibrium conditions are not met.

4. Adsorption is reversible and instantaneous. This is conservative as desorption is usually a slower process than adsorption and some chemicals may never completely desorb.

5. Soil contamination extends from the surface to the water table. In reality the source often does not extend to the water table. This is a conservative assumption

6. The potential receptor well is within the plume.

ASSUMPTIONS FOR GROUND WATER MIGRATION AND DILUTION

1. No chemical dispersion is accounted for. This is conservative in that chemical concentrations will be over estimated by these equations.

2. No adsorption within the aquifer in accounted for. This is conservative as the chemical concentrations will be over estimated.

3. Mixing is due only to horizontal trasnport and dilution by infiltrating rain water. Flow is assumed to by laminar and follows Darcy's Law. If Darcy assumptions are incorrect and flow becomes turbulent, the mixing is more complete than would be predicted by the equations.

4. The aquifer is assumed to act as an equivalent porous media. On the scale of transport at Mound, the fractured bedrock will not have preferential fracture transport pathways.

The equations incorporate a standard linear equilibrium soil/water partition equation to estimate contaminant release in soil leachate (equations 1 & 2) and a simple water-balance equation that calculates a dilution factor to account for dilution of soil leachate in an aquifer (equations 2 & 3). The dilution factor represents the reduction in soil leachate contaminant concentrations by mixing in the aquifer, expressed as the ratio of leachate concentration to the concentration in ground water at the receptor point (receptor well or point of compliance).

Simple PRS or Release Block SSLs are back calculated from acceptable ground water concentrations (i.e. non-zero MCLs). First the acceptable ground water concentration is multiplied by the dilution/attenuation factor (DAF) to obtain a target leachate concentration. For example, if the DAF is 10 and the acceptable ground water concentration is 0.05 mg/L, the target soil leachate concentration would be 0.5 mg/L. The partition equation (equation 1) is then used to calculate the total soil concentration or soil screening level (SSL) corresponding to this soil leachate concentration.

1.0 SOIL LEACHING

Utilizing the calculated guideline values for ground water (acceptable water concentration) from HAZWRAP, a corresponding soil concentration or soil screening level (SSL) can be calculated from:

$$SSL = C_w\{K_d + (\theta_w + (\theta_a H'))/\rho_b\} \qquad \textbf{(Equation 1)}$$

$$K_d = K_{oc} * f_{oc} \qquad \textbf{(Equation 2)}$$

where

Parameter	Definition	Units
C_w	target soil leachate. Acceptable water concentration * DAF	mg/L
K_d	soil-water partition coefficient (K_{oc} * f_{oc} for organic chemicals)	L/kg
θw	saturated porosity	
θa	air filled porosity	
H	Henry's Law constant * 41 (0 for metals and radionuclides)	
ρ_b	dry soil bulk density	kg/L
K_{oc}	soil organic carbon/water partition coefficient	L/kg
f_{oc}	fraction organic carbon in soil	

2.0 DILUTION/ATTENUATION

As contaminants in soil leachate move through the soil and ground water, they are subjected to physical, chemical, and biological processes that tend to reduce the eventual contaminant concentration at the receptor point. The processes include adsorption onto soil and aquifer media, chemical transformation, biological degradation, and dilution due to mixing of the leachate with ambient ground water. The reduction in concentration can be expressed by the DAF, which is defined as the ratio of contaminant concentration in soil leachate to the concentration in ground water at the receptor point. The DAF is used to back-calculate the target soil leachate concentration from an acceptable ground water concentration.

This simple site-specific model addresses only one of these dilution-attenuation processes: contaminant dilution in ground water. A simple equation, broken into two parts for ease of use, derived from geohydrologic water-balance relationships is used. This simplifying use of only ground water dilution is used for several reasons.

First, the assumption that the source will last infinitely, results in all subsurface adsorption sites being eventually filled and no longer available to attenuate contaminants. Second, soil contamination is assumed to extend to the water table, eliminating attenuation processes in the unsaturated zone. Finally, chemical specific biological and chemical degradation rates are not known for many chemicals and where they are known there is a wide range in values.

MIXING ZONE DEPTH (d)

One aspect of the model is the determination of the depth that a contaminant leachate will mix in the aquifer. This is called the mixing zone depth and it is dependent upon the rainfall infiltration rate, the length of the source term parallel to the ground water flow direction, the horizontal distance to a potential ground water receptor, and the hydraulic gradient. The mixing zone depth equals the thickness of the saturated portion of the aquifer if mixing is completely effective. This can occur if the aquifer is relatively thin and the distance to the potential receptor is relatively great.

$$d = (0.0112(L+x_r)^2)^{0.5} + d_a\{1 - \exp[(-in(L+x_r))/Kid_a]\} \qquad \text{(Equation 3)}$$

where

Parameter	Definition	Units
L	source length parallel to ground water flow	m
d_a	aquifer thickness	m
K	hydraulic conductivity	m/y
i	hydraulic gradient at the source	m/m
x_r	horizontal distance to receptor	m
in	infiltration rate	m/y

Equation 2 assumes that the mixing depth cannot exceed the thickness of the aquifer. The equation is composed of two terms. The first term relates vertical mixing due to horizontal ground water flow, the second term relates the downward infiltration component due to rainfall recharge.

For Mound we assume that ground water contaminants from potential release sites that overlie the bedrock will be governed by this equation. This mixing zone depth equation is appropriate for use at PRSs that directly overlie the BVA, however the distance to the receptor must be assumed to be 0 m.

Once the mixing zone depth has been calculated, the actual dilution-attenuation factor (DAF) is calculated from the following equation:

$$DAF = 1 + Kid/inL \qquad \text{(Equation 4)}$$

where the parameters are the same as in equation 2 and d = the mixing zone depth (equation 3).

Equation 3 incorporates the result of the calculated mixing zone depth with the volume of water that is traversing beneath the contaminant site. This is the effective dilution that occurs in the aquifer. This dilution could be as low as a factor of 1 if it is assumed that a receptor well is located within the leachate at the source term.

The calculated DAF shall be multiplied by the acceptable soil leachate concentration (back calculated from MCLs or risk derived concentrations) to obtain the target soil leachate concentration (C_w). The target soil leachate concentration is utilized in equation 1 to obtain the site specific SSL.

Additional dilution takes place when the migrating contaminant joins the BVA. It is reasonable to assume that any well that a resident installs for drinking water in the BVA is unlikely to located exactly at the edge of the BVA. This additional mixing that will take place is not accounted for in this SSL model. The assumption that the potential receptor is at the exact edge of the BVA, where the aquifer is too thin for a productive well is conservative.

SITE SPECIFIC DATA VALUES

These equations require site specific data for:

Parameter	Definition	SM/PP Hill top soil	Main Hill top soil	Units
L	source length parallel to ground water flow	45	45	m
d_a	aquifer thickness (DOE 1994)	10	15	m
K	hydraulic conductivity (DOE 1994)	52	52	m/y
i	hydraulic gradient at the source	site specific	site specific	m/m
x_r	horizontal distance to receptor	site specific	site specific	m
in	infiltration rate (Schairbaum & Frost 1988)	0.15	0.15	m/y
K_d	soil-water partition coefficient (K_{oc} * f_{oc} for organic chemicals)	chemical specific	chemical specific	L/kg
θ_w	saturated porosity	0.15	0.15	
θ_a	air filled porosity	0.28	0.28	
H	Henry's Law constant * 41 (0 for metals and radionuclides)	chemical specific	chemical specific	
ρ_b	dry soil bulk density	1.5	1.5	kg/L
K_{oc}	soil organic carbon/water partition coefficient	chemical specific	chemical specific	L/kg
f_{oc}	fraction organic carbon in soil (DOE Mound Plant Database)	0.02	0.02	

SOIL POROSITY AND DENSITY DETERMINATION

Although the soils at Mound rarely extends completely to the aquifer, a conservative assumption is that the soils do extend to the aquifer, providing a larger potential source that can desorb contaminants into the ground water.

The determination of the average soil pH is 7.45 from the Mound Plant site specific soil database.

The Mount Plant surface soils are typical of loam type soils. The f_{oc} from the Mound Plant soil database is 2.0%. There are no site specific values obtained for the soil bulk density or porosity. The default values that USEPA (USEPA, 1994) provides will be used in these equations.

HYDRAULIC GRADIENT DETERMINATION

The hydraulic gradient for a given PRS will be determined from nearby wells, or will be determined to be the same as the slope of the topography (or bedrock in fill areas) at the PRS location.

DISTANCE TO A POTENTIAL RECEPTOR

The distance to a potential receptor will be determined to be along the ground water flow direction until ground water encounters the edge of the BVA. The Mound Facility Boundary may be determined to define the distance to a potential receptor if it is deemed possible that a down gradient potential receptor well may be installed at or near the site boundary.

SOURCE LENGTH PARALLEL TO THE GROUND WATER FLOW DIRECTION

The size of the potential source can be quite variable. For PRS evaluation purposes, a length of 45 meters will be used which corresponds to a 1/2 acre potential source area. Soil chemical concentrations for this half acre area will be averaged. For some PRS's, the size is known to be substantially less, and the corresponding smaller value will be used in the equations.

CHEMICAL SPECIFIC PARAMETERS (H and K_{oc})

The values of H and K_{oc} are from the Technical Background Document for Soil Screening Guidance (USEPA. 1994). Although this draft document states that this document should not be cited or quoted. personal communication with Robert Truesdale of RTI indicates that these values may be used in the equations.

CHEMICAL NAME	H	Koc L/kg		Kd L/kg	MCL mg/L	10-6 Guideline Value mg/L		
Acenapthene	7.54E-03	5846	0.2	1169.2	—			
Acetone	1.18E-03	0.46	0.2	0.092	—	3.6		
Aldrin	4.22E-03	94623	0.2	18924.6	—			
Anthracene	4.55E-03	18162	0.2	3632.4	0.007			
Arochlor 1016	—	147410	0.2	29482	—			
Arochlor 1254	—	892520	0.2	178504	—	0.00073		
Arochlor 1260	—	4425557	0.2	885111.4	—	0.00001[illegible]		
Benzene	2.24E-01	66	0.2	13.2	0.005			
Benzo(a)anthracene	1.48E-04	272847	0.2	54569.4	0.007			
Benzo(b)flouranthene	2.53E-04	882588	0.2	176517.6	0.007			
Benzoic Acid	1.37E-05	—	0.2		—	140		
Benzo(a)pyrene	3.43E-05	749569	0.2	149913.8	0.0002			
Bis(2-chlorethyl)ether	8.77E-04	76	0.2	15.2	—			
Bis(2-ethylhexyl)phthalate	3.43E-04	94361	0.2	18872.2	—			
Bromodichloromethane	1.30E-01	54	0.2	10.8	0.08			
Bromoform	2.52E-02	97	0.2	19.4	0.08			
Butanol	3.50E-04	5	0.2	1	—			
Butyl benzyl phthalate	7.83E-05	15975	0.2	3195	—	7.3		
Carbazole	8.12E-05	2441	0.2	488.2	—			
Carbon disulfide	5.21E-01	52	0.2	10.4	—	0.033		
Carbon tetrachloride	1.18E+00	187	0.2	37.4	0.005			
Chlordane	2.73E-03	61155	0.2	12231	0.002			
p-Chloroaniline	4.80E-05	41	0.2	8.2	—			
Chlorobenzene	1.79E-01	213	0.2	42.6	—			
Chlorodibromomethane	1.02E-01	72	0.2	14.4	0.08			
Chloroform	1.65E-01	47	0.2	9.4	0.08			
2-Chlorophenol	6.81E-04	—	0.2		—			
Chrysene	4.96E-05	312425	0.2	62485	—	0.0046		
DDD	2.03E-04	84937	0.2	16987.4				
DDE	5.08E-03	108469	0.2	21693.8		0.00017		
DDT	2.20E-03	77577	0.2	15515.4		0.001		
Dibenzo(a,h)anthracene	4.59E-07	1914389	0.2	382877.8	—			
Di-n-butyl phthalate	5.86E-05	16851	0.2	3370.2	—	3		
1,2-Dichlorobenzene (o)	8.61E-02	693	0.2	138.6	0.6			
1,2-Dichlorobenzene (p)	1.15E-01	653	0.2	130.6	0.075			
3,3-Dichlorobenzidene	8.53E-07	2441	0.2	488.2	—			
1,1-Dichloroethane	2.36E-01	35	0.2	7	—	1.1		
1,2-Dichloroethane	5.25E-02	20	0.2	4	0.005			
1,1-Dichloroethylene	1.04E+01	64	0.2	12.8	0.007			
cis-1,2 Dichloroethylene	1.85E-01	29	0.2	5.8	0.07			
trans-1,2-Dichloroethylene	2.29E-01	50	0.2	10	0.1			
1,2-Dichloropropane	1.15E-01	59	0.2	11.8	0.005			
1,3-Dichloropropene	1.21E-01	33	0.2	6.6	—			
2,4-Dichlorophenol	9.76E-06	—	0.2		—			
Dieldrin	1.09E-04	18388	0.2	3677.6	—	0.0018		
Diethyl phthalate	2.24E-05	152	0.2	30.4	—			
2,4-Dimethylphenol	1.33E-04	—	0.2					
Dimethyl phthalate	2.37E-05	32	0.2	6.4				

CHEMICAL NAME	H	Koc		Kd	MCL	10-6 Guideline Value		
2,4-Dinotrotoluene	6.03E-06	51	0.2	10.2	—			
2,6-Dinotrotoluene	5.33E-06	42	0.2	8.4	—			
Di-n-octyl phthalate	3.14E-05	9.8E+08	0.2	1.96E+08		0.73		
Endosulfan	9.47E-04	738	0.2	147.6				
Endrin	4.88E-05	9335	0.2	1867	0.002			
Ethylbenzene	3.18E-01	388	0.2	77.6	0.7			
Fluoranthene	3.83E-04	72025	0.2	14405		0.87		
Fluorene	2.99E-03	9226	0.2	1845.2	—			
Heptachlor	2.41E-02	11651	0.2	2330.2	0.0004			
Heptachlor epoxide	3.40E-04	7236	0.2	1447.2	0.0002			
Hexachlorobenzene	2.19E-02	27996	0.2	5599.2	0.001			
Hexachloro-1,3-butadiene	9.80E-01	6992	0.2	1398.4	—			
alpha-HCH (alpha-BHC)	2.78E-04	1310	0.2	262				
beta-HCH (beta-BHC)	1.42E-05	1392	0.2	278.4		0.000047		
gamma-HCH (lindane)	1.39E-04	1085	0.2	217	0.0002			
Hexachlorocyclopentadien	7.05E-01	9589	0.2	1917.8	0.05			
Hexachloroethane	1.48E-01	1829	0.2	365.8	—			
Indeno(1,2,3-c,d)pyrene	1.99E-07	4364700	0.2	872940	—	0.000026		
Isophorone	2.54E-04	30	0.2	6	—	7.2		
Mercury	4.67E-01	—	0.2		0.002			
Methoxychlor	2.60E-04	77936	0.2	15587.2	0.04			
Methyl bromide	5.82E-01	11	0.2	2.2				
Methyl chloride	1.85E+00	7	0.2	1.4				
Methylene chloride	9.72E-02	13	0.2	2.6				
2-Methylphenol	6.72E-05	—	0.2					
Napthalene	1.98E-02	1549	0.2	309.8	—			
Nitrobenzene	8.45E-04	—	0.2					
N-Nitrosodiphenylamine	2.86E-02	327	0.2	65.4				
N-Nitrosodi-n-propyamine	1.70E-03	17	0.2	3.4				
Pentachlorobenzene	—	13274	0.2	2654.8				
Pentachlorophenol	5.82E-04	—	0.2		0.001			
Phenol	2.44E-05	—	0.2		—	22		
Pyrene	3.39E-04	59865	0.2	11973	—	0.68		
Styrene	1.37E-01	573	0.2	114.6	0.1			
1;1,2,2-Tetrachloroethane	1.53E-02	104	0.2	20.8	—			
Tetrachloroethylene	7.09E-01	139	0.2	27.8	0.005			
Toluene	2.52E-01	171	0.2	34.2	1			
Toxaphene	1.38E-04	501	0.2	100.2	0.003			
1,2,4-Trichlorobenzene	1.07E-01	1840	0.2	368	0.07			
1,1,1-Trichloroethane	7.63E-01	110	0.2	22	0.2			
1,1,2-Trichloroethane	4.10E-02	61	0.2	12.2	0.005			
Trichloroethylene	4.35E-01	112	0.2	22.4	0.005			
2,4,5-Trichlorophenol	1.80E-04	—	0.2					
2,4,6-Trichlorophenol	1.66E-04	—	0.2		—			
Vinyl acetate	2.26E-02	5	0.2	1				
Vinyl chloride	3.45E+00	11	0.2	2.2	0.002			
Xylenes (total)	2.48E-01	381	0.2	76.2	10			

CHEMICAL NAME	H	Koc		Kd	MCL	10-6 Guideline Value		
Antimony			0.2		0.006			
Arsenic			0.2		0.05			
Barium			0.2		2			
Beryllium			0.2		0.004			
Bromate			0.2		0.01			
Cadmium			0.2		0.005			
Chloramine			0.2		4			
Chlorine			0.2		4			
Chlorine Dioxide			0.2		0.8			
Chromium (total)			0.2		0.1			
Cyanide			0.2		0.2			
Fluoride			0.2		4			
Mercury			0.2		0.002			
Nickel			0.2		0.1			
Nitrate			0.2		10			
Nitrite			0.2		1			
Selenium			0.2		0.05			
Sulfate			0.2		500			
Thallium			0.2		0.002			
			0.2					
Radium 226			0.2		20			
Radon			0.2		300			
Tritium			0.2		20			
			0.2		20.000			
Actinium 227			0.2			0.076		
Americium 241			0.2			0.15		
Bismuth 207			0.2			9.4		
Cesium 137			0.2			1.5		
Cobalt 60			0.2			2.5		
Plutonium 238			0.2			0.16		
Plutonium 239			0.2			0.15		
Plutonium 240			0.2			0.15		
Strontium 90			0.2			0.85		
Thorium 228			0.2			0.21		
Thorium 230			0.2			1.3		
Thorium 232			0.2			1.5		

EXAMPLE SSL CALCULATION FOR THE B-BUILDING SOLVENT SHED

B-Building Solvent Shed SSL Calculations

B-Building Solvent Shed

Definition	Parameter	Main Hilltop soil
source length parallel to ground water flow	L	10
aquifer thickness (DOE 1994)	da	15
hydraulic conductivity (DOE 1994)	K	52
hydraulic gradient at the source	i	0.008
horizontal distance to receptor	xr	150
infiltration rate (Schairbaum & Frost 1988)	in	0.15
soil-water partition coefficient (Koc * foc for organic chemicals)	Kd	chemical specific
saturated porosity	Ow	0.15
air filled porosity	Oa	0.28
Henry's Law constant * 41 (0 for metals and radionuclides)	H	chemical specific
dry soil bulk density	B	1.6
soil organic carbon/water partition coefficient	Koc	chemical specific
fraction organic carbon in soil (DOE Mound Plant Data Base)	foc	0.02

CALCULATED SOIL SCREENING LEVELS (acceptable concentrations to remain in soils)	
CHEMCIAL	SSL
	mg/kg
Trichoroethene	0.0621748
Toluene	18.358506
1,1,1-TCA	2.5049478
cis,1-2DCE	0.2550524
Freon 113*	—

* TLV in air is 1000ppm

CACULATED 95% UCL FROM VERIFICATION SAMPLES	95% UCL
CHEMICAL	mg/kg
Trichoroethene	0.045
Toluene	0.014
1,1,1-TCA	0.011
cis,1-2DCE	0.03
Freon 113*	0.008
* TLV in air is 1000ppm	

CONCLUSION
Since acceptable soil screening level concentrations exceed the 95% UCL from the verification sampling, there is no need for additional remediation.

Mixing Zone Depth Calculation

MIXING ZONE DEPTH (d)

$d = (0.0112(L+xr)^2)^{0.5} + da(1 - \exp[(in(L+xr))/Kida)])$ (Equation 3)

DILUTION FACTOR (df) (Equation 4)

$df = 1 + Kid/inL$

CALCULATED PARAMETERS

d	15	mixing zone thickness (m)
df=	5.16	dilution factor

SOIL SCREENING LEVEL CALCULATION

$SSL = Cw(Kd + (Ow + (OaH))/B)$ (Equation 1)

$Kd = Koc * foc$ (Equation 2)

INPUT PARAMETER DEFINITION

MCL	mg/L	
Cw	mg/L	target soil leachate. Acceptable water concentration * df
Kd	L/kg	soil-water partition coefficient
Ow		saturated porosity
Oa		air filled porosity
H		Henry's Law constant * 41 to make dimensionless
B	kg/L	dry soil bulk density
Koc	L/kg	soil organic carbon/water partition coefficient
foc	g/g	fraction organic carbon in soil

CALCULATED SOIL SCREENING LEVELS

CHEMICAL	MCL/Guide Value	Cw	H	Koc	Kd	SSL
	mg/L	mg/L		L/kg	L/kg	mg/kg
Trichoroethene	0.005	0.0258	0.435	112	2.24	0.062175
Toluene	1	5.16	0.252	171	3.42	18.35851
1,1,1-TCA	0.2	1.032	0.763	110	2.2	2.504948
cis,1-2DCE	0.07	0.3612	0.185	29	0.58	0.255052
Freon 113*	1.9	9.804	—	—	—	—

* TLV in air is 1000ppm

Gradient Calculation between wells 113 and 114

Date	Well 114	Well 113	Hirizontal	Gradient
	Water elevation	gw elev.	Distance	
5/5/93	821.6	824.3	575	0.004696
5/19/93	821.62	824.11	575	0.00433
6/2/93	821.59	823.47	575	0.00327
9/2/93	821.54	821.09	575	-0.00078
10/6/93	821.62	821.54	575	-0.00014
11/2/93	821.63	823.67	575	0.003548
12/14/93	821.64	823.75	575	0.00367
2/15/94	821.62	851.59	575	0.052122
4/28/94	821.6	824.24	575	0.004591
			Average =	0.008367

REFERENCES

Schairbaum, J.R. and Frost, J.P. 1988. "The Hydrology of Sicamore Farm - A Preliminary Report." Center for Ground water Management, Wright State University. September 20, 1988.

DOE. 1994. "Operable Unit 9, Hydrogeologic Investigation: Bedrock Report." U.S. Department of Energy, Albuquerque Field Office, Albuquerque, New Mexico. January, 1994.

USEPA. 1994. "Technical Background Document for soil Screening Guidance - Review Draft." U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. EPA/540/R-94/106 December, 1994

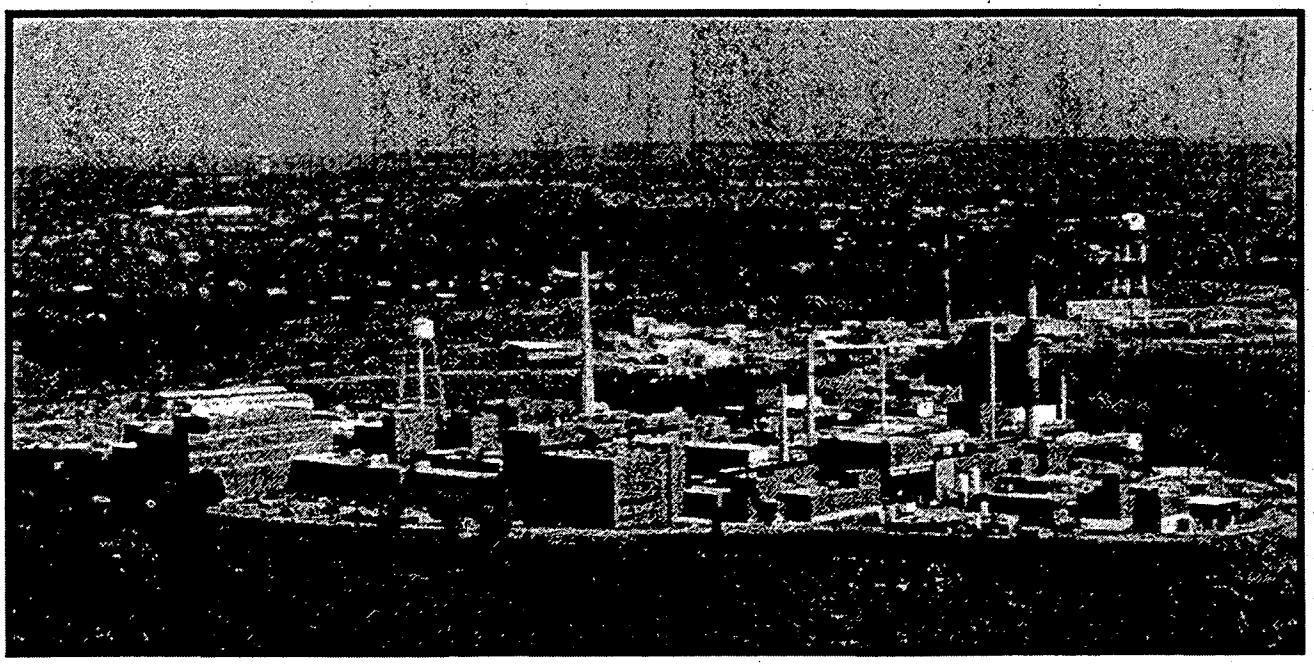
MOUND

Environmental
Restoration
Program

Miamisburg Closure Project
Potential Release Site Package

PRS 397

Final
June 2003



The Mound Core Team
P.O. Box 66
Miamisburg, Ohio 45343-0066

June 2003

Mr. Daniel Bird, AICP
Planning Manager
Miamisburg Mound Community Improvement Corporation
720 Mound Road
COS Bldg. 4221
Miamisburg, Ohio 45342-6714

Dear Mr. Bird:

The Core Team, consisting of the U.S. Department of Energy Closure Project (DOE-MCP), U.S. Environmental Protection Agency (USEPA), and the Ohio Environmental Protection Agency (OEPA), appreciates your comment on the PRS 397 Public Review Draft Package. Attached is our response.

Should the response to comments require additional detail, please contact Paul Lucas at (937) 847-8350 extension 314 and we will gladly arrange a meeting or telephone conference.

Sincerely,

DOE/MCP:	Paul Lucas Paul Lucas, Remedial Project Manager	6/18/03 date
USEPA:	David P. Seely David P. Seely, Remedial Project Manager	6/24/03 date
OEPA:	Brian K. Nickel Brian K. Nickel, Project Manager	6/18/03 date

Response to Public Comments

from MMCIC
on PRS 397 Public Review Draft Package
February 2003

Comment 1. From our review of the PRS 397 Public Review Draft, MMCIC concurs that a No Further Assessment response is appropriate for this PRS. MMCIC understands that subsequent soil sampling found that the levels of BTEX and PAH are below the risk based guideline value. TPH was not detected in the sample.

Response 1. Thank you for your review and support of a No Further Assessment decision. MMCIC's understanding, as stated above, is consistent with that of the Core Team.

Environmental Restoration Program

MIAMISBURG CLOSURE PROJECT
POTENTIAL RELEASE SITE PACKAGE
Notice of Public Review Period

The following Potential Release Site (PRS) packages are available for public review in the CERCLA Public Reading Room, 305 E. Central Ave., Miamisburg, Ohio. Public comment on these documents will be accepted 26 February 2003 through 27 March 2003.

PRS 41: Area 3 Thorium Drum Storage/Redrum
PRS 64: Building 19 Historic Gasoline Tank
PRS 397: Soil Contamination

Questions can be referred to Paul Lucas at (937) 865-4578

PRS 397 Package Tracking Sheet

REVISION	DESCRIPTION	DATE
Working Draft (to DOE)		
Draft (to Core Team)		
Draft Proposed Final	Addendum 1 submitted to CT. No USEPA or OEPA comments. Added Addendum 1 to original package and submitted it as public review draft.	**January 2003**
Public Review Draft	Binned NFA on 19 February 2003. Public review period: 26 Feb to 27 Mar 03	**February 2003**
Final	There were no public comments that required changes to the document.	**June 2003**

ADDENDUM 1

SUPPORTING NFA RECOMMENDATION

MOUND

Environmental
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Program

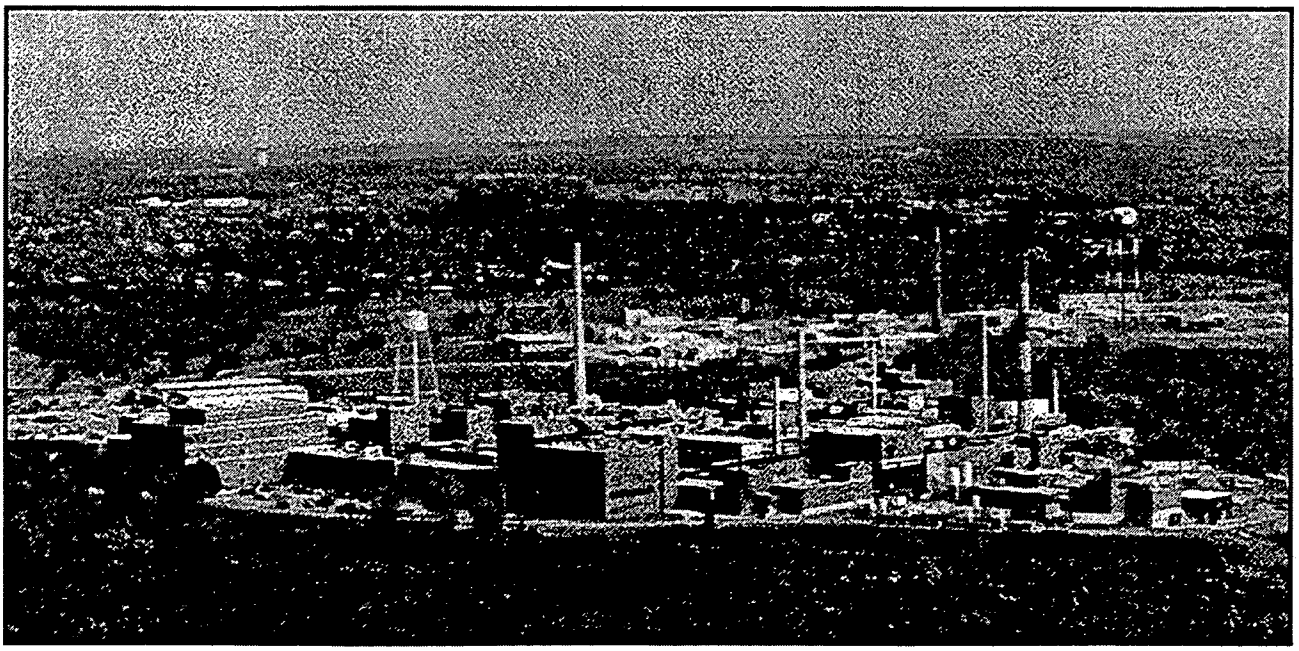
Miamisburg Closure Project

Potential Release Site Package

PRS 397

Addendum 1

Final
June 2003



PRS HISTORY:

Potential Release Site (PRS) 397 is located south of the former fuel tanks (Figure 1) and was binned Further Assessment (FA) by the Core Team on 3 October 1996. PRS 398 (soil gas location near the fuel pumps) was binned jointly with PRS 397 but, due to its proximity to PRS 66, was subsequently included in the PRS 66 effort. This addendum addresses only PRS 397. PRS 397 was identified based on a soil sample (Sample ID SEPW) collected as part of the passive soil gas survey in 1994[1]. Further Assessment sampling was completed in December of 2002 per the Sampling and Analysis Plan (**SAP**)[2] approved by the Core Team.

FURTHER ASSESSMENT ACTIVITY:

The potential contaminants of concern (COCs) were benzene, toluene, ethylbenzene, and xylene (BTEX) and total petroleum hydrocarbon (TPH). Although not a COC, the Core Team agreed to add polyaromatic hydrocarbon (PAH) analyses based on two historic results in the PRS 397 vicinity that indicated benzo(a)pyrene at concentrations above the 10^{-6} Risk-Based Guideline Values (RBGVs).

One soil sample and and one duplicate sample were analyzed for the COCs and for PAH. The FA sample location is presented in Figure 2. The FA **Data Report**[3] presents a full account of soil sampling activities and sample results. All analyses were performed by an offsite laboratory (Severn Trent Laboratories, St. Louis).

There were no FA sample results above detection limits for any of the analytes. All detection limits were significantly below the more restrictive of the 10^{-6} RBGV or the Hazard Index of one value.

FIGURES:

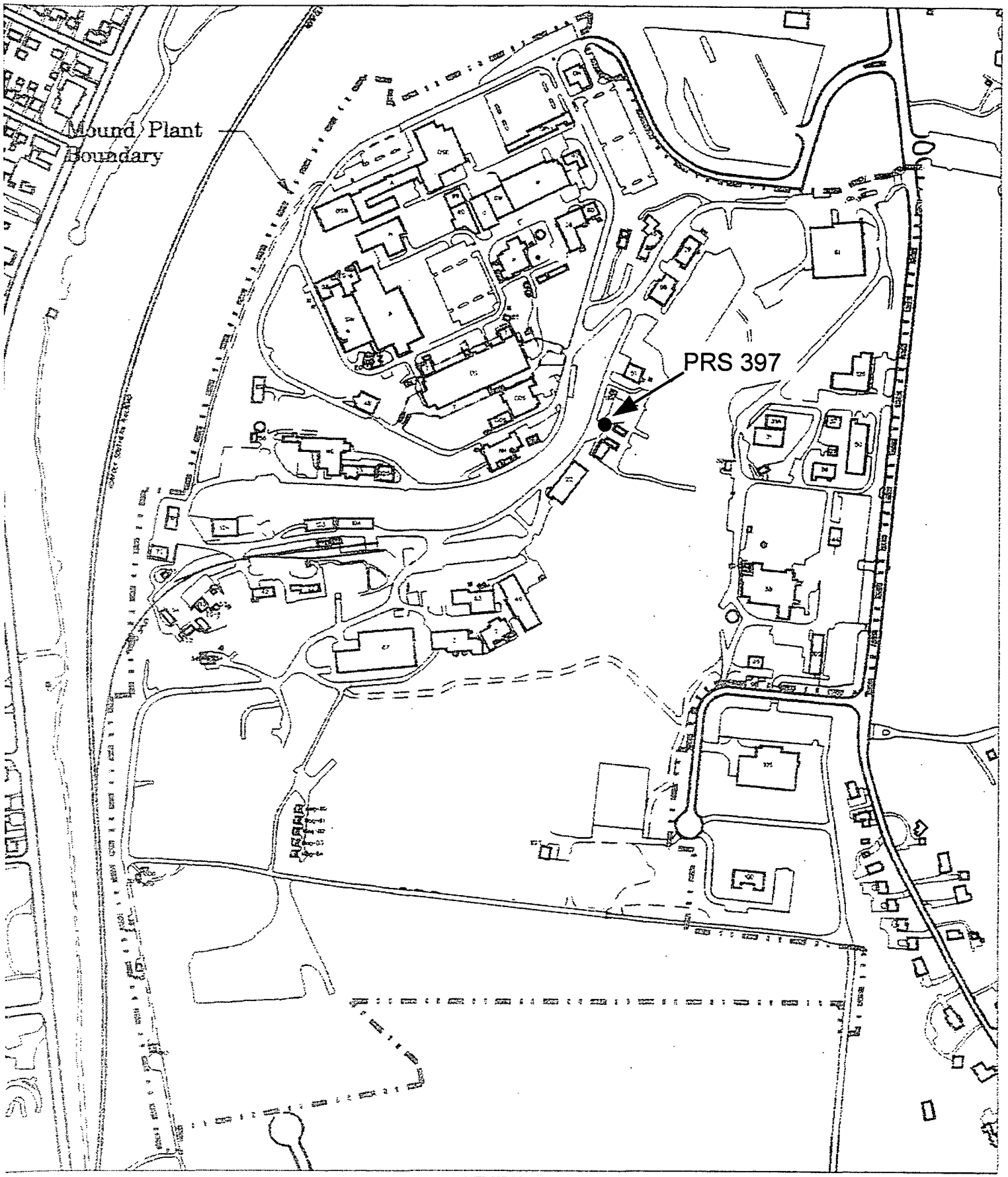
Figure 1: Location of PRS 397
Figure 2: PRS 397 Sample Location

REFERENCES:

1) Operable Unit 5, Operational Area Phase I Investigation Non-AOC Field Report, Final (Revision 0) June 1995
2) PRS 397 Sampling & Analysis Plan, Final, September 2002
3) PRS 397 Data Report, Rev. 0, December 2002

PREPARED BY:

Gary Miller, CH2MHill, ER Technical Staff
Karen M. Arthur, CH2MHill, ER QA



Legend
Structures
Paved roadway
Unpaved roadway
Mound Plant boundary
Railroad
0 100 200 400 600 800 1000
Scale in Feet

DATE	REVISION	BY	CHKR	DIC	UNCK	APVD	#
09/18/02	*	SSR					

Figure 1: Location of PRS 397

2 of 4

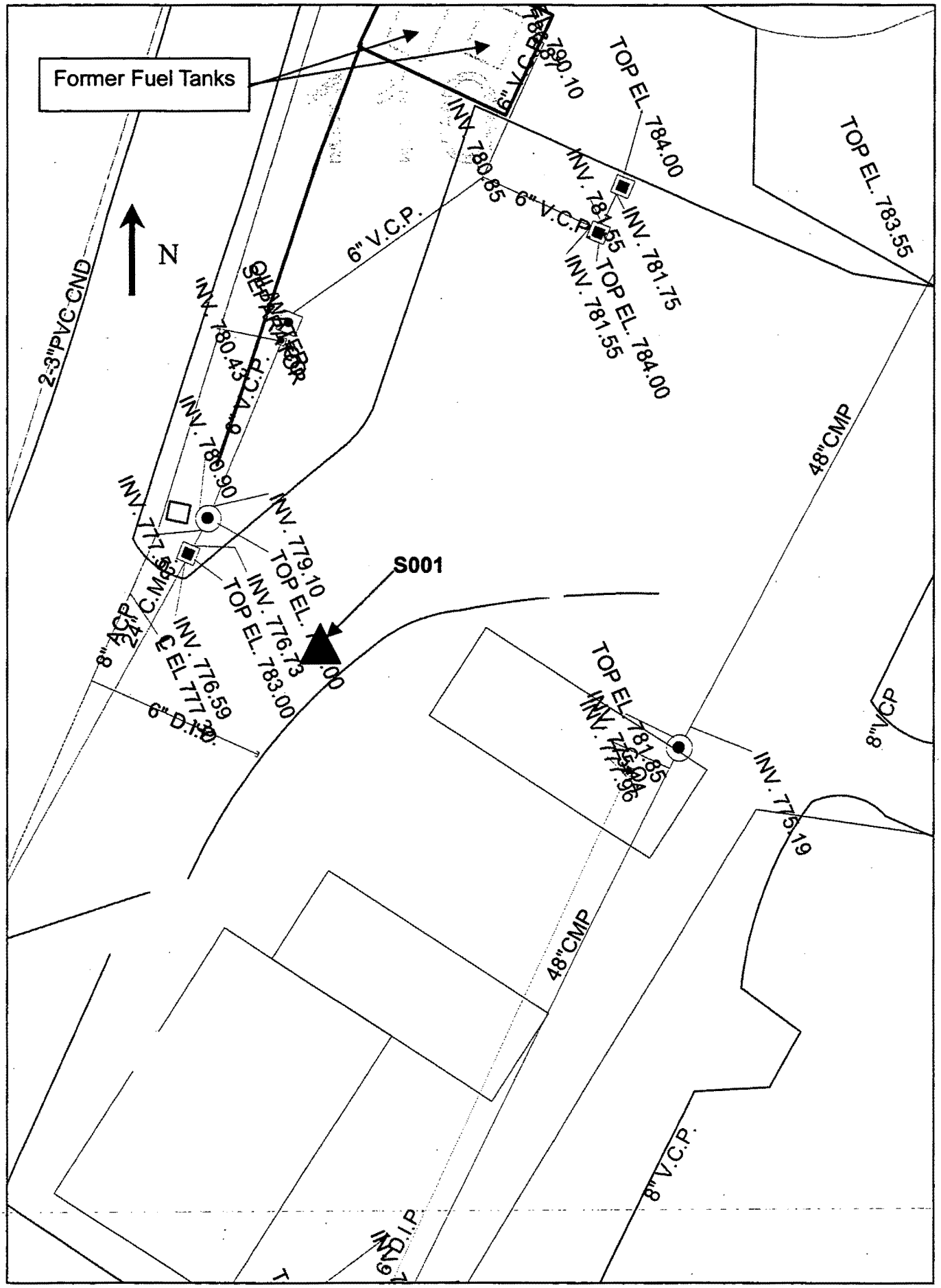


Figure 2: PRS 397 Sample Location

3 of 4

MIAMISBURG CLOSURE PROJECT
PRS 397

RECOMMENDATION:

Potential Release Site (PRS) 397 is located south of the former fuel tanks (Figure 1) and was binned Further Assessment (FA) by the Core Team on 3 October 1996. PRS 397 was identified based on a soil sample (Sample ID SEPW) collected as part of the passive soil gas survey in 1994.

Further Assessment was performed and confirmed that the levels of BTEX and PAH are acceptable when compared to the more stringent of the 10^{-6} RBGV or Hazard Index of one values. TPH was not detected in the sample.

Therefore, the Core Team recommends **No Further Assessment** for PRS 397.

A PRS Package with an NFA recommendation signed by the Core Team will be placed in the Public Reading Room for a 30-day review period. Upon closure of the public review comments, if any, the PRS Package will be issued as a final document and made available in the Public Reading Room.

CONCURRENCE:

DOE/MCP: _____ 2/19/03
Robert S. Rothman, Remedial Project Manager (date)

USEPA: _____ 2/19/03
David P. Seely, Remedial Project Manager (date)

OEPA: _____ 2/19/03
Brian K. Nickel, Project Manager (date)

ORIGINAL DOCUMENT

SUPPORTING FA RECOMMENDATION

Environmental
Restoration
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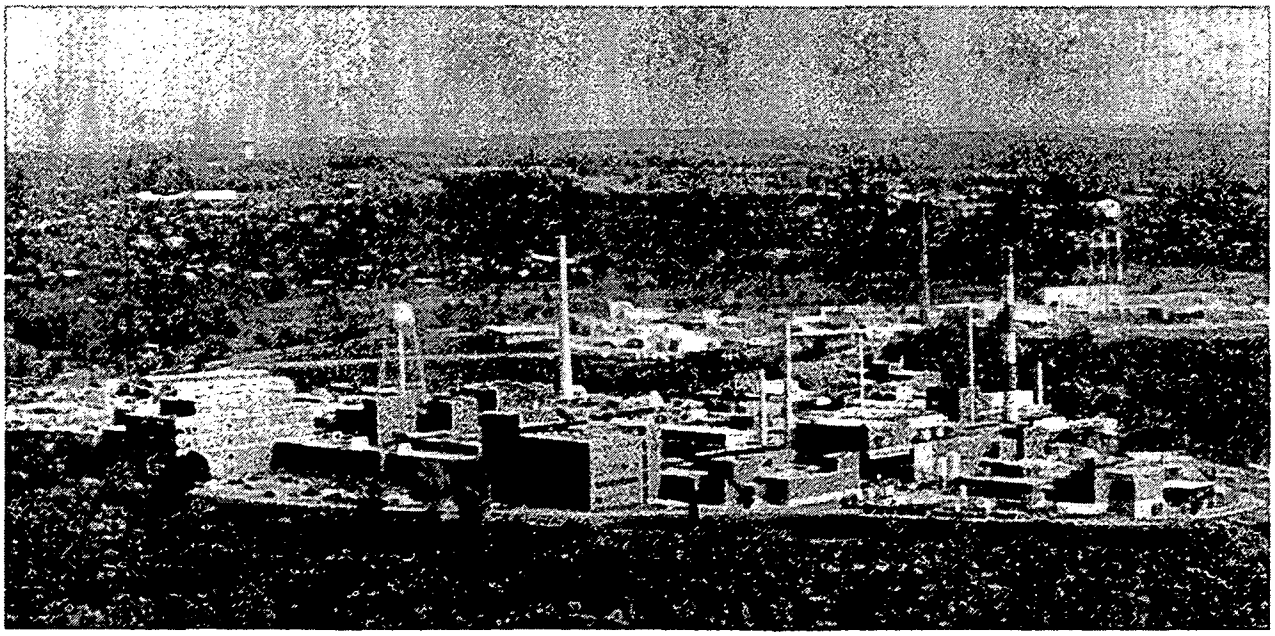
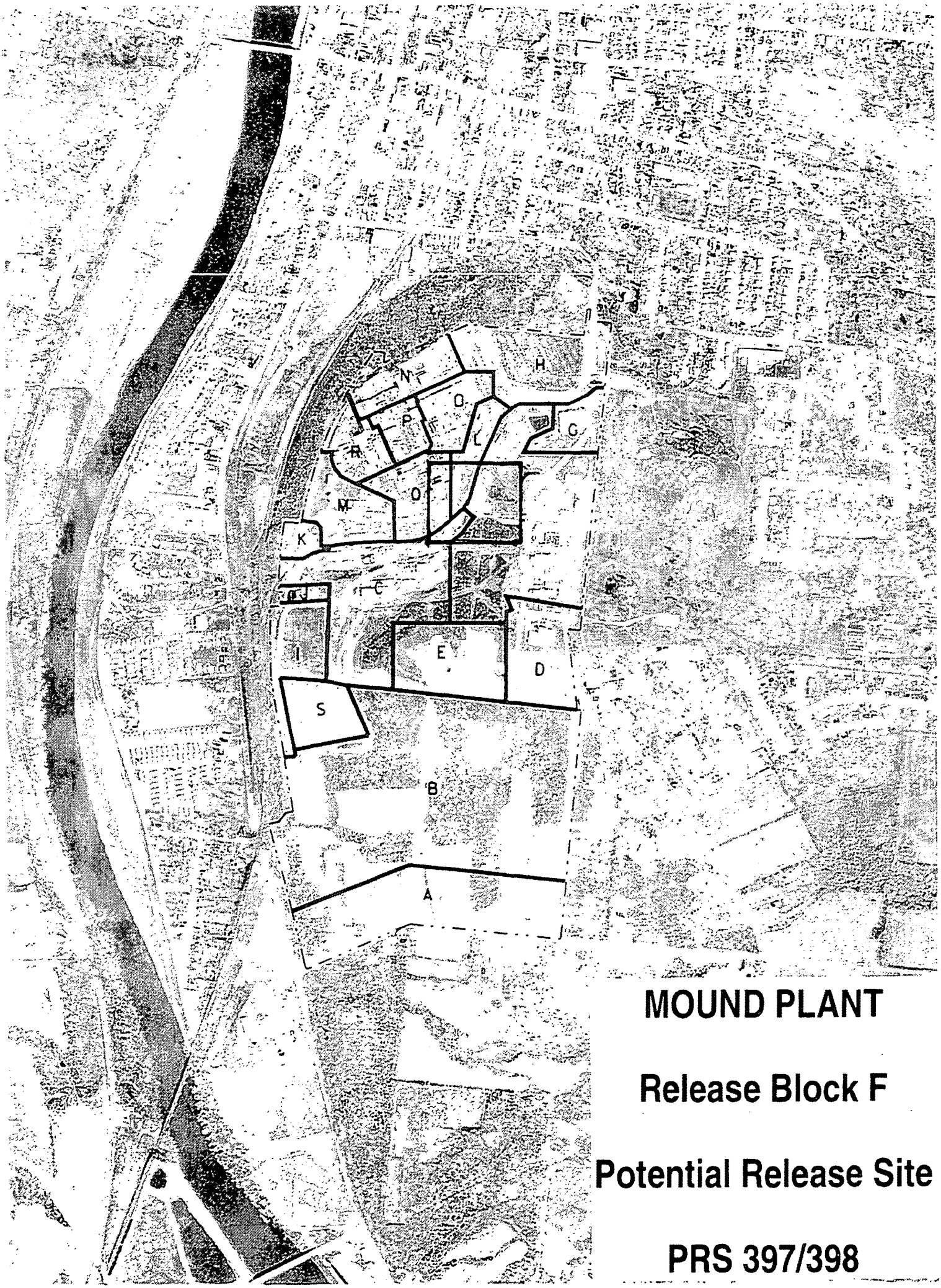
MOUND PLANT

Potential Release Site Package

PRS #397/398



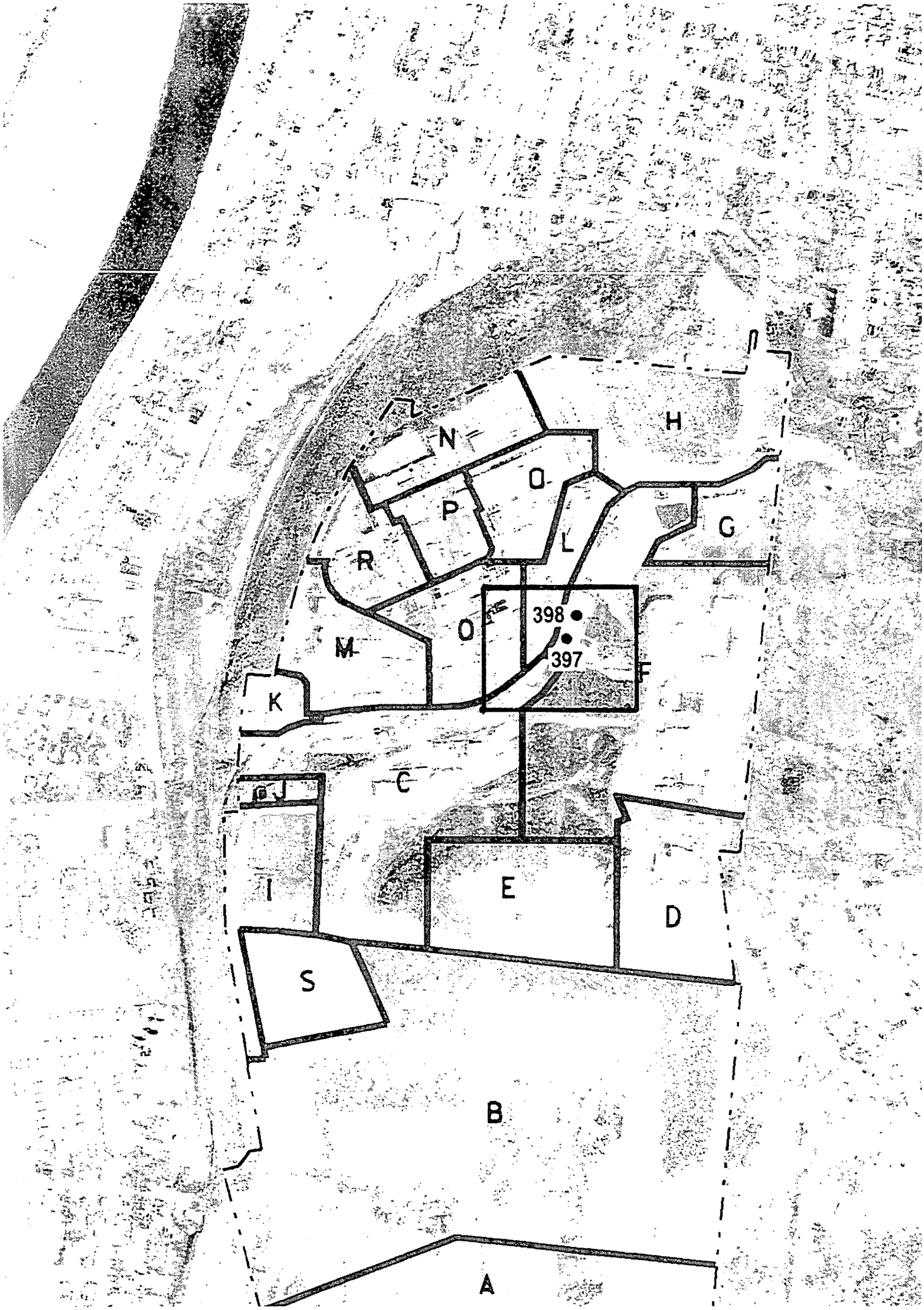


MOUND PLANT

Release Block F

Potential Release Site

PRS 397/398


N
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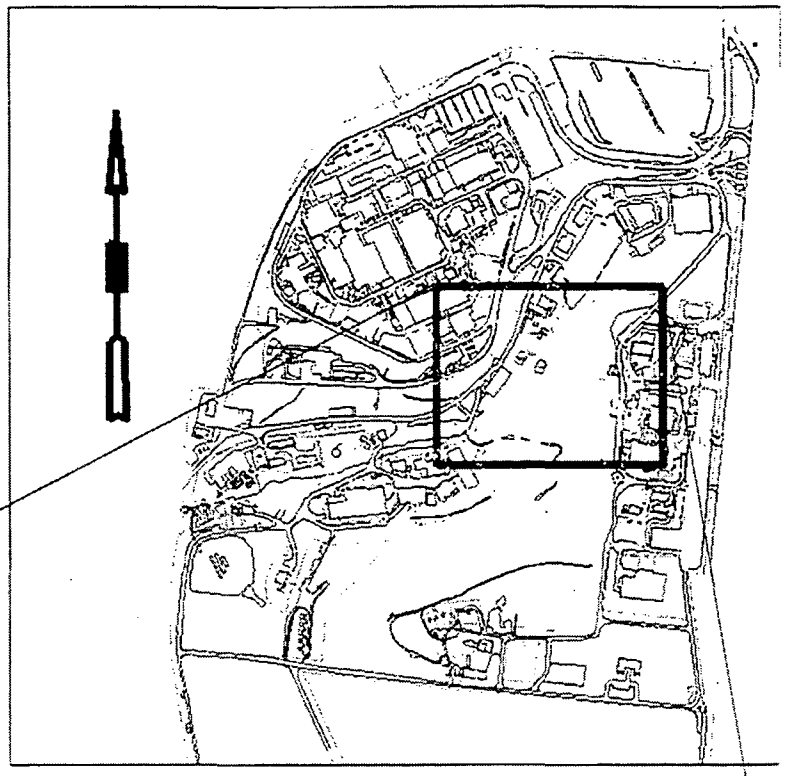
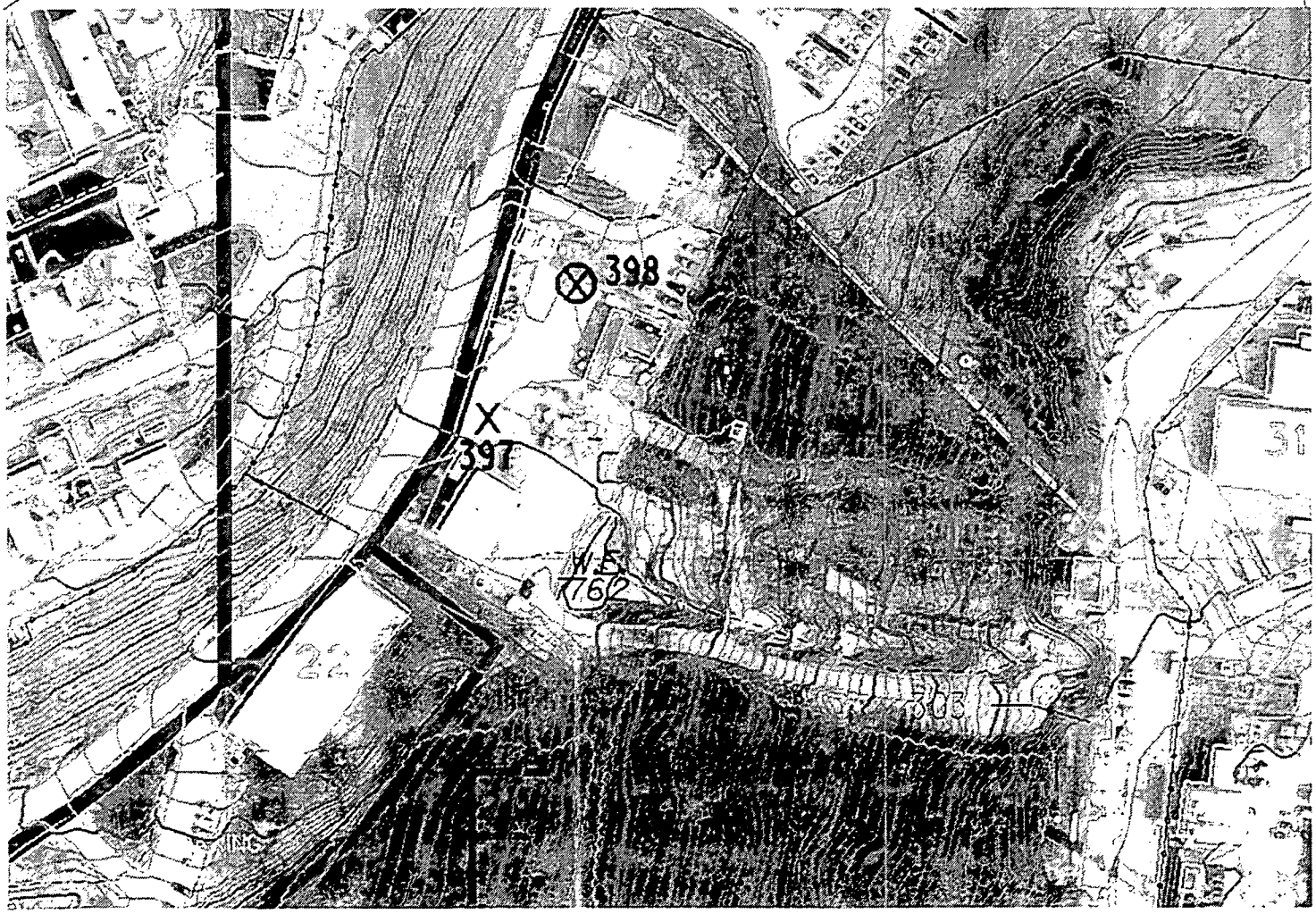
Mound Plant

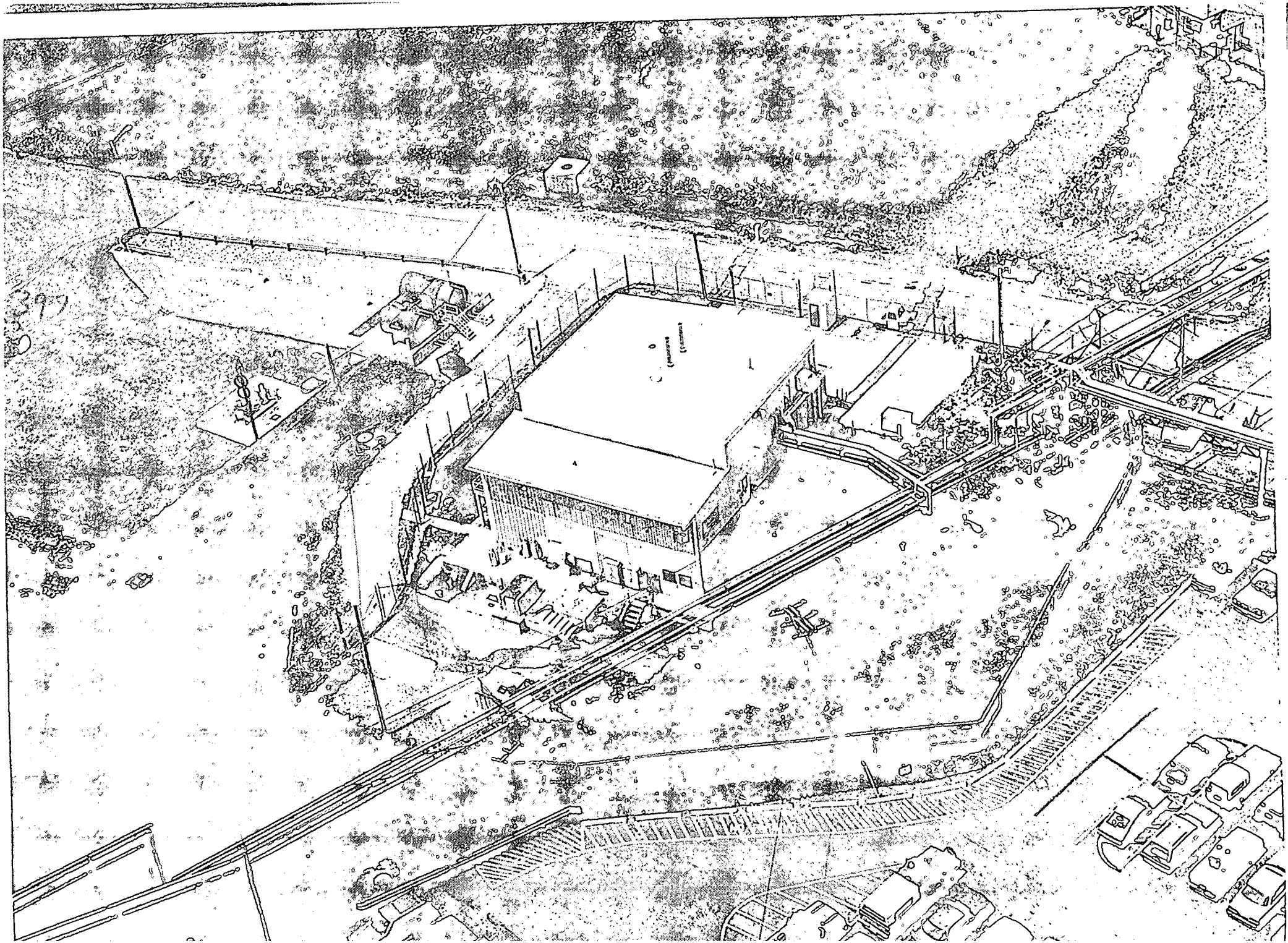
Release Block F

Potential Release Site

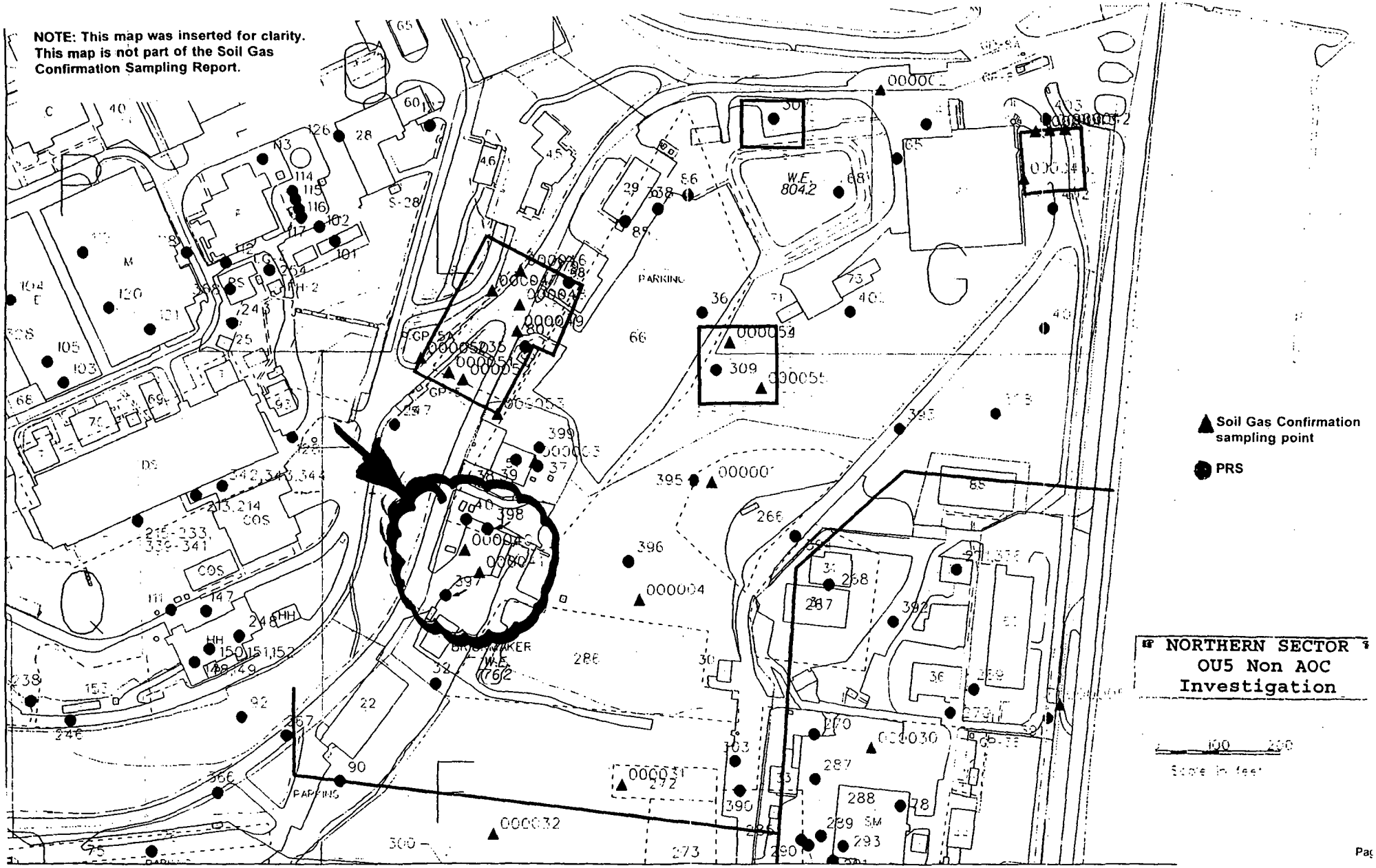
PRS 397/398







NOTE: This map was inserted for clarity.
This map is not part of the Soil Gas Confirmation Sampling Report.



PRS 397/398

PRS HISTORY:

Potential Release Sites (PRS) 397 and 398 are located in the parking lot of the refueling facility, south of Building 51 and north of Building 22. PRSs 397 and 398 were identified in the Operable Unit 5, Operational Area Phase 1 Investigation Non-AOC Field Report.[1] The investigation of the non-areas of concern (non-AOC) generally included areas that were not known or suspected to be contaminated. As part of scoping for the study, areas of special interest with the possibility of the presence of hazardous substances were identified. One such area, the "Fuel Area" was included in the study and now encompasses PRS 397 and 398. For the remainder of this paper, PRSs 397 and 398 will be referred to as the Fuel Area.

The Fuel Area is built on fill materials. In the late 1960s and 1970s, the upper reach of the plant drainage ditch was filled to allow development, including construction of Building 51.[2] The area between buildings 22 and 51 lay largely undeveloped for many years. Building 66, a modular transportable building, was used in the area immediately south of Building 51 in the late 1970s and early 1980s, this designation is still apparent on many maps. The Fuel Area facilities were constructed in 1986 to replace the G Building facilities on the Main Hill. The Fuel Area facilities consist of 2 above ground fuel tanks, 2 gasoline pumps, and a water/oil separator.[1]

CONTAMINATION:

Two soil gas surveys have been conducted in the Fuel Area: a broad, passive soil gas survey, conducted in the Fuel Area in 1994, the results of which identify PRSs 397 and 398; and a reconnaissance soil gas survey, conducted in the Building 51 area in 1992.

1) The passive soil gas survey was conducted in 1994 as part of the *OU5, Operational Area Phase 1 Non-AOC* field investigation.[1] This investigation included a field instrument for detection of low energy radiation (FIDLER) survey; surface soil sampling and analysis using the Mound Plant soil screening facility; and a PETREX passive soil gas survey to detect volatile and semi-volatile hydrocarbons and total petroleum hydrocarbons. A single, relatively moderate detection of halogenated hydrocarbons was noted just north of PRS 398, to the east of the tanks. PRS 397 exhibits relatively low to moderate total aromatic hydrocarbons, total semi-volatile hydrocarbons and total petroleum hydrocarbons. Seven other sample locations in the Fuel Area, however, exhibit relatively low to moderate levels of all organic parameters. The PETREX soil gas methods generally indicate the relative presence of a substance, but do not yield a quantitative concentration of that substance. Review of the data files used to compile the distribution maps indicates that the analytical results were dominated by toluene, ethylbenzene, and xylene, as well as other compounds related to medium and heavy weight fuels.

Soil samples from each of the soil gas detector holes were submitted to the Mound soil screening facility. The results indicated that no plutonium-238 or thorium-232 occurred in concentrations above the Mound as low as reasonably achievable (ALARA) goal of 25 pCi/g for plutonium or the regulatory guideline of 5 pCi/g for thorium.[7]

2) As part of the *Reconnaissance Soil Gas Survey*[3], 8 locations were sampled and analyzed for volatile organic compounds near the Fuel Area. The study collected gas samples at 5-foot depths and analyzed them in an on-site mobile lab using a gas chromatograph (equivalent to U.S. EPA Method 8021). The results of the survey indicated that traces of haiogenated and petroleum hydrocarbons are present[3] (see Table 1).

Table 1 Results for which concentration can be compared to Guideline Criteria:

Contaminant	Maximum Concentration Detected	Calculated Guideline Criteria
Cis-1,2 Dichloroethane (1,2 DCE)	18 ppb[3] (soil gas)	5,000 ppb[4] (soil gas)
1,1,1-Trichloroethane (1,1,1-TCA)	37 ppb[3] (soil gas)	173,400 ppb[4] (soil gas)
Tetrachloroethene (PCE)	44 ppb[3] (soil gas)	3,100 ppb[4] (soil gas)
Trichloroethene (TCE)	207 ppb[3] (soil gas)	2,400 ppb[4] (soil gas)
Toluene	37 ppb[3] (soil gas)	414,600 ppb[4] (soil gas)

3) In February 1996, the *Soil Gas Confirmation Investigation*[6] sampled the soil at 100 locations on the Mound plant site. Each sample was collected over a depth of 1 to 3 feet and analyzed for volatiles, semivolatiles, PCBs, pesticides, metals, radionuclides, and explosives. The investigation did not sample the location of PRS 397 or 398, however two *Soil Gas Confirmation* samples were taken in the Fuel Area (see map on page 44 for location of samples 41 and 40 in relation to PRS 397 and 398) within approximately 50 feet of the PRS locations.

Results showed that the samples in the vicinity of PRS 397 and 398 contained contaminant concentrations less than the applicable 10^{-6} Risk Based Guideline Value, regulatory guideline or ALARA guideline with the exception of:

Contaminant	Sample Locations in Excess of Guideline Criteria	Maximum Concentration Detected	Guideline Criteria
Benzo(a)pyrene	40, 41	570 ug/kg (in soil @ location 40)	410 ug/kg[7] (10^{-6} Risk Based limit in soil)

ug = micrograms, kg = kilograms

READING ROOM REFERENCES:

1) Operable Unit 5, Operable Area Phase 1 Investigation Non-AOC Field Report, June 1995. (pages 7-18)
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7) Code of Federal Regulations, 40 CFR 192.12 and 40 CFR 192.41.

PREPARED BY:

Alexander Bray, Member of EG&G Technical Staff
William Criswell, Member of EG&G Technical Support Staff

MOUND PLANT
PRS 397/398

RECOMMENDATION:

CONCURRENCE:

DOE/MB: _____
Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA: _____
Timothy J. Fischer, Remedial Project Manager (date)

OEPA: _____
Brian K. Nickel, Project Manager (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from _____ to _____.

☐ No comments were received during the comment period.
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Alexander Bray, Member of EG&G Technical Staff
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MOUND PLANT
PRS 397/398

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REFERENCE MATERIAL
PRS 397/398

Document Control No._____

Environmental Restoration Program

OPERABLE UNIT 5
OPERATIONAL AREA PHASE I INVESTIGATION
NON-AOC FIELD REPORT

MOUND PLANT
MIAMISBURG, OHIO

VOLUME II - APPENDICES A-G

June 1995

Final (Revision 0)

U.S. Department of Energy
Ohio Field Office

EG&G Mound Applied Technologies

APPENDIX E
SOIL GAS SURVEY REPORT

Final Report of the PETREX® Soil Gas Survey
Of The Non-Area of Concern, Operable Unit 5

U.S. Department of Energy Mound Facility
Miamisburg, Ohio

2.0 INTRODUCTION

With the aid of Northeast Research Institute LLC (NERI), Science Applications International Corporation (SAIC) recently completed a Petrex soil gas survey of the NonArea of Concern (NonAOC) of Operable Unit -5 (OU-5) of the U. S. Department of Energy's Mound Facility in Miamisburg, Ohio. The survey of the NonAOC was performed as part of a larger soil gas survey of the entire OU-5 area including seven defined Areas of Concern.

The NonAOC encompasses the majority of the facility within the boundaries of OU-5 excepting the smaller, embedded Areas of Concern (AOC-3, AOC-7, AOC-13, AOC-21, AOC-22, AOC-J, and Area-SDB). The NonAOC was divided-up into four geographical units, NonAOC-South, NonAOC-West, NonAOC-East, and NonAOC-North to accommodate practical limitations in field operations. Two subunits of NonAOC-North, Area-61 and the Fuel Area, were also recognized (see Plate 1). Samplers from individual geographical units were collected and analyzed as separate phases of the larger soil gas survey of OU-5.

Past and current land use within the NonAOC varies. Some portions of the NonAOC may consist of undisturbed ground while other areas may have been extensively regarded and used for storage of facility wastes. Some portions of the NonAOC currently house structures in which various chemical products are stored or processed. Due to this diverse history, subsurface contamination by numerous volatile and semivolatile organic compounds (VOC's and SVOC's) is suspected. These compounds include components of petroleum products (fuels, oils, and lubricants), coal tar products (such as creosote), halogenated and nonhalogenated solvents (such as xylenes, and PCE), and refrigerants (CFC's or Freons). The purpose of this Petrex soil gas survey was to locate areas within the NonAOC which exhibit potential subsurface contamination by VOC's and SVOC's. The information generated by this survey could then be used to 1) determine what compounds may impact soil or groundwater quality, 2) locate areas of greatest potential impact and areas where these compounds might have been buried or released, and 3) strategically plan quantitative testing of soil and groundwater to determine the regulatory significance of findings site-wide.

3.0 OBJECTIVES

The technical objectives of the Petrex soil gas survey of the NonAOC were to:

1. Collect and identify VOC's and SVOC's in the subsurface.

2. Report results for targeted VOC's and SVOC's and illustrate their areal distribution on-site through mapping of results.

3. Determine the location of possible sources of subsurface contamination and identify areas meriting quantitative investigation.

4.0 OVERVIEW OF THE PETREX TECHNIQUE

Each Petrex soil gas sampler consists of two or three activated charcoal adsorption elements (collectors) housed in a resealable glass container in an inert atmosphere.

Soil gas sample collection is performed by unsealing the sampler and exposing the collector to the soil gas of the subsurface environment at the base of a shallow bore hole. Sample collection proceeds via free vapor diffusion through the opening of the uncapped sampler container. Following a controlled period of time, the sampler is retrieved from the bore hole, resealed, and submitted for analysis.

One collector from each soil gas sampler is analyzed by Thermal Desorption - Mass Spectrometry (TD-MS). Selected second collectors may be analyzed by Thermal Desorption - Gas Chromatography/Mass Spectrometry (TD-GC/MS) for compound confirmation. At least ten percent of samplers used in any project contain three collectors. The third collector is used for setting instrument sensitivity prior to analysis.

Compounds are identified by comparison to standard reference spectra derived from the same instrument. The mass spectral ion count of the appropriate indicator peak(s) for each compound or group of compounds is then plotted as relative response on a map and contoured using a variety of standard geostatistical analyses.

For a more detailed and technical discussion of the method, please refer to Appendix A, Petrex Protocol.

5.0 SCOPE OF WORK

The scope of work of the soil gas survey of the NonAOC specified collection and analysis of soil gas samples from a total of three hundred and ninety-six (396) sample collection points. The majority of these sample collection points was arrayed in a uniform grid which overlaid the NonAOC. The distance between sample collection points within the sampling grid was one hundred feet. This sampling grid corresponds to a rectangular coordinate system that extends 2,800 feet to the north and 2,700 feet to the west from an origin in the southeast of the facility (see Plate 1 provided with this report). Approximately twenty sample collection points were strategically located outside of the uniform rectangular grid near suspected contaminant sources areas.

~~The NonAOC-South encompasses approximately thirty acres or the southern one-third of OU-5 (south of coordinate 7 North). A total of one hundred and thirty-one (131) Petrex soil gas sample collection points were distributed across this area. The terrain within the NonAOC-South is near level in the eastern half, but slopes downward to the west from the mid-point with an average grade of 15%.~~

the occurrence of the subsurface dispersion and migration of components of these products to other portions of the site.

Detections of elevated levels of halogenated hydrocarbons in the soil gas within the NonAOC-East were infrequent. Prominent occurrences of PCE were noted at the collection points of samples #915, #919, and #941. Prominent occurrences of TCE were detected in the soil gas at the collection points of samples #915 and #956. No other halogenated organics were detected at elevated levels in the soil gas within the NonAOC-East.

The pronounced levels of petroleum hydrocarbons in samples #923, #946, #948, and #953 has potentially masked response to halogenated hydrocarbons greater than 100,000 ion counts. To determine whether elevated levels of halogenated organics may be present in these four samples, sample duplicates have been submitted for TD-GC/MS analysis. TD-GC/MS analysis of these four samples is pending. Results will be reported as soon as they are available.

8.2.4 NonAOC-North

High relative levels of petroleum hydrocarbons were detected at many points within the NonAOC-North, particularly in the Fuel Area and in the eastern half of the site both along the border with the NonAOC-East and at several points surrounding Building No. 61.

The majority of the sampling points within the Fuel Area demonstrated highly elevated levels of aromatic petroleum hydrocarbons, specifically toluene and ethylbenzene/xylenes (see the mass spectra of samples #1075, and #1083). Sample #1074 however, also demonstrated high relative levels of heavier weight aromatics, and medium to heavy weight alkanes, cycloalkanes/alkenes, and cycloalkenes/dienes which are common to medium and heavy weight fuels (see the mass spectrum of sample #1074). The high levels of toluene and ethylbenzene/xylenes in the soil gas at points on the periphery of the Fuel Area (such as the collection points of samples #1079 through #1083) suggest that the toluene and ethylbenzene/xylenes detected in this and other portions of the NonAOC derive wholly from fuels and not from suspected potential purer sources of these aromatics such as solvents or thinners.

Soil gas at numerous points in the east of the NonAOC-North exhibited compositions similar to that detected in the Fuel Area to the far west. Specifically, samples #847, #856, #857, #888, #896, #897, and #973 demonstrated combinations of C_4 to C_{11} petroleum hydrocarbons typical of the composition of vapor derived from slightly weathered light to medium weight fuels. While samples #853, #855, #980, and #1014 demonstrated pronounced singular occurrences of the C_6 and C_7 aromatics toluene and ethylbenzene/xylenes. These findings suggest that the hydrocarbons in the subsurface in the eastern half of the NonAOC-North may have originated in a similar fashion as the hydrocarbons in the subsurface in the Fuel Area.

The most significant occurrences of semivolatile hydrocarbons, as determined by the number of contiguous samples exhibiting elevated response, were detected in the southern portion of NonAOC-East. The highest response levels detected in this area were detected northeast of Building No. 39, east of Building No. 102 and at the collection point of sample #953 (located south of the parking lot). Isolated occurrences of semivolatile hydrocarbons were identified east of Building No. 38, and along the property boundary located east of Building No. 36 in the NonAOC-East.

Potentially significant occurrences of semivolatile hydrocarbons were identified in the northeastern section of the NonAOC-North, which includes Area-61, and in the Fuel Area. In Area-61, elevated response levels were detected adjacent to the northeastern portion of Building No. 61 and extend east to the access road. The elevated response detected at the collection point of sample #974 (at grid coordinate 27N5W) reflects the occurrence of high levels of naphthalenics principally naphthalene and methylnaphthalene. Of all of the samples collected within the NonAOC, this one sample exhibits character most unlike vapor derived from fuels and most like vapor derived from a coal tar product.

In the Fuel area, a single sample, #1074, collected from a point adjacent to the fuel pumps exhibited a high level of semivolatile hydrocarbons. The semivolatile hydrocarbons in this sample co-occur with a broad mixture of other hydrocarbons typical of the composition of only partially weathered fuels. Isolated occurrences of semivolatile hydrocarbons were also detected west of Buildings No. 61 and No. 33, and northwest of the access road at the collection point of sample #904.

In the NonAOC-South, only one area exhibited a small zone of elevated levels of semivolatile hydrocarbons which may relate to potential subsurface contamination. This zone is was located west of Building No. 100 and extends north beyond the access road. An isolated occurrence of semivolatile hydrocarbons was also identified in the soil gas at the collection point of sample #86.

In NonAOC-West only a limited number of isolated occurrences of semivolatile hydrocarbons was identified. Most of these occurrences were detected along the access roads, however single samples exhibiting high relative levels were collected east of Buildings No. 19 and No. 94. The environmental significance of discrete detections is difficult to ascertain. They are most likely related to low level near surface soil contamination rather than potentially significant subsurface contamination. The occurrences identified in close proximity to the access roads may be related to road use and/or maintenance (i.e., oiling dirt roads to minimize dust).

As the mobility of organic compounds in the subsurface environment generally decreases with increasing molecular weight or complexity of molecular structure, high levels of C_9, C_{10}, and C_{11} semivolatile compounds in the soil gas likely correspond to points of release of these and other petroleum hydrocarbons. It is equally likely that the occurrence of semivolatile hydrocarbons in the soil gas across the greater NonAOC represents small scale contamination of near surface soils and not any widespread impact to subsurface media.

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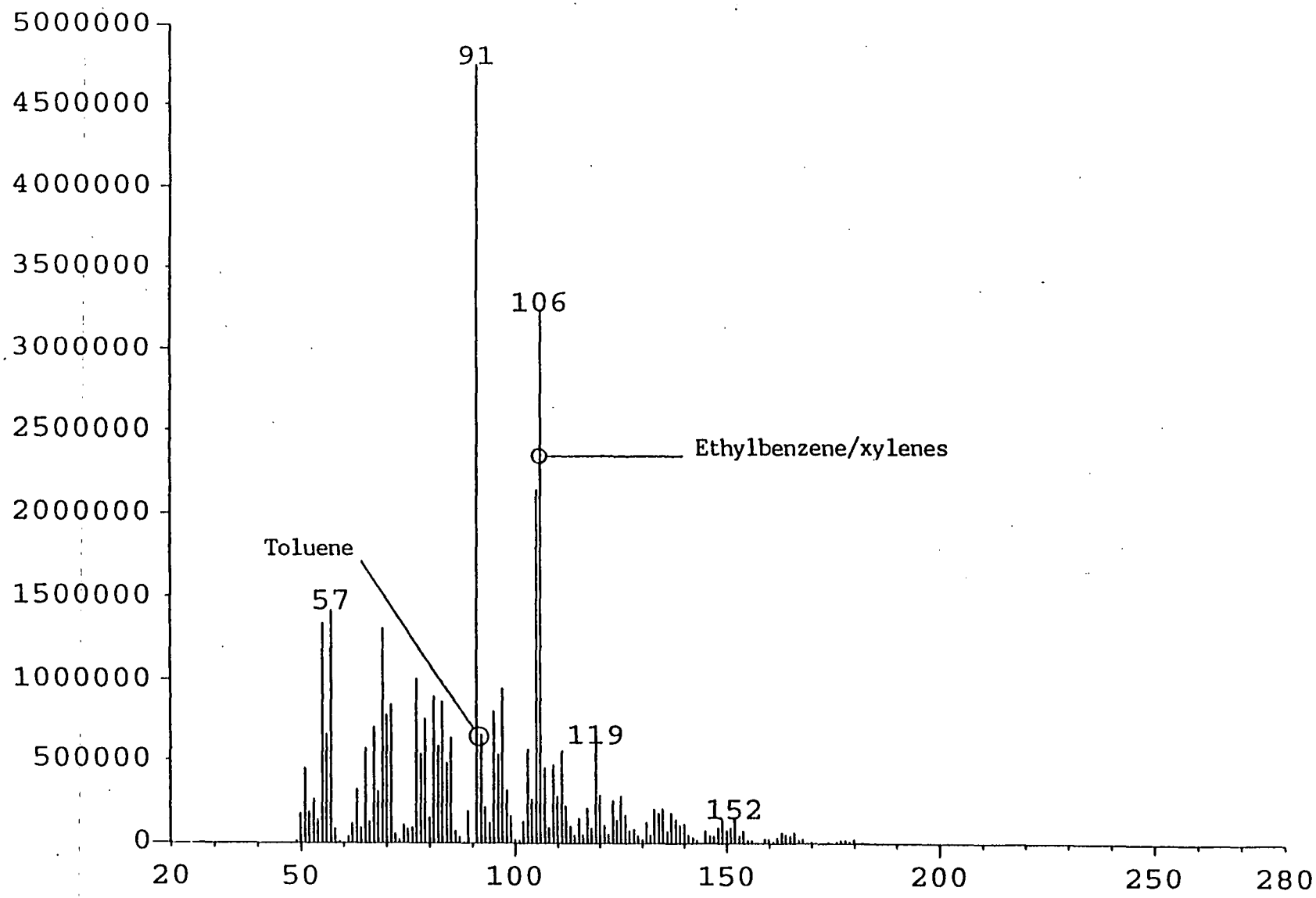

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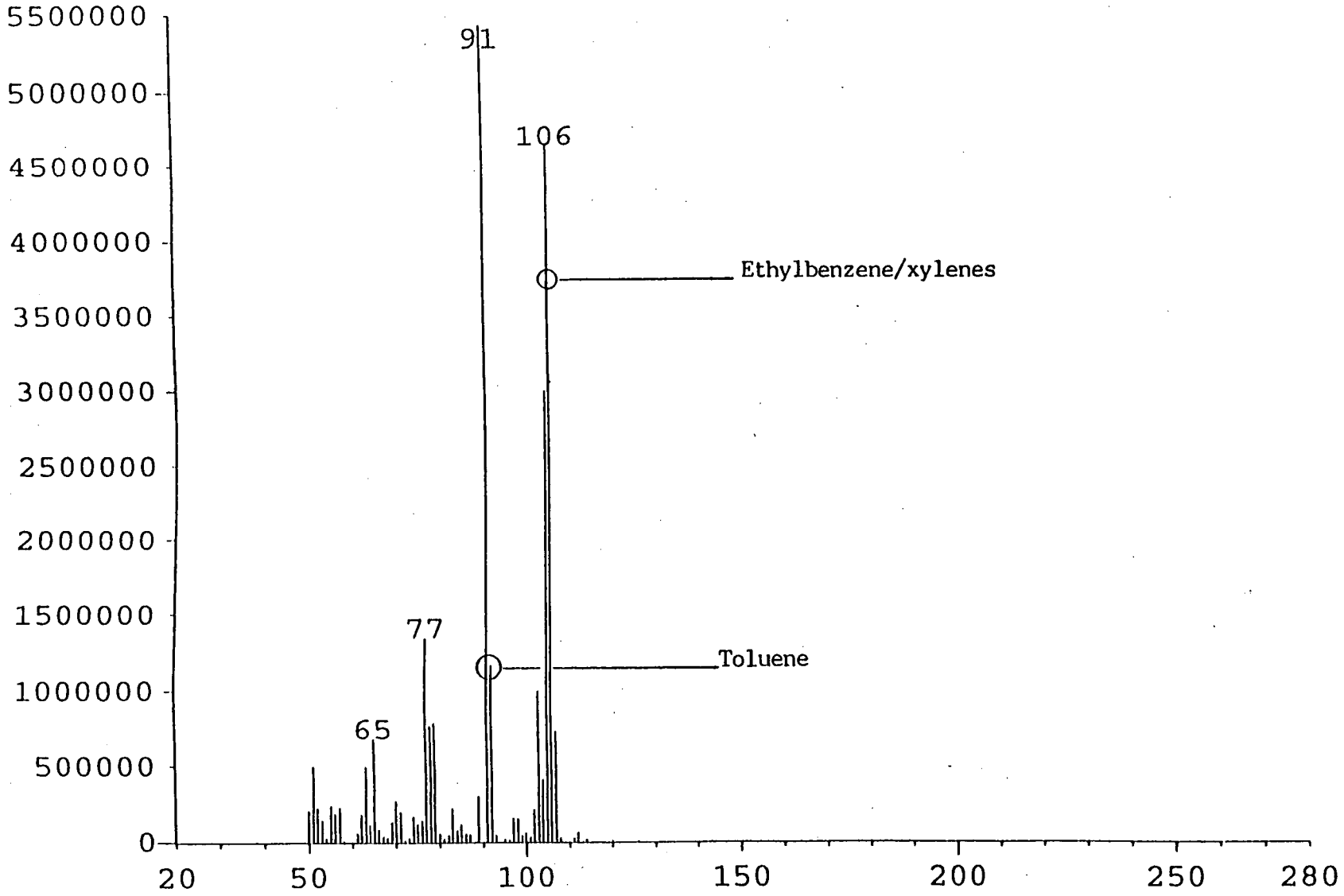
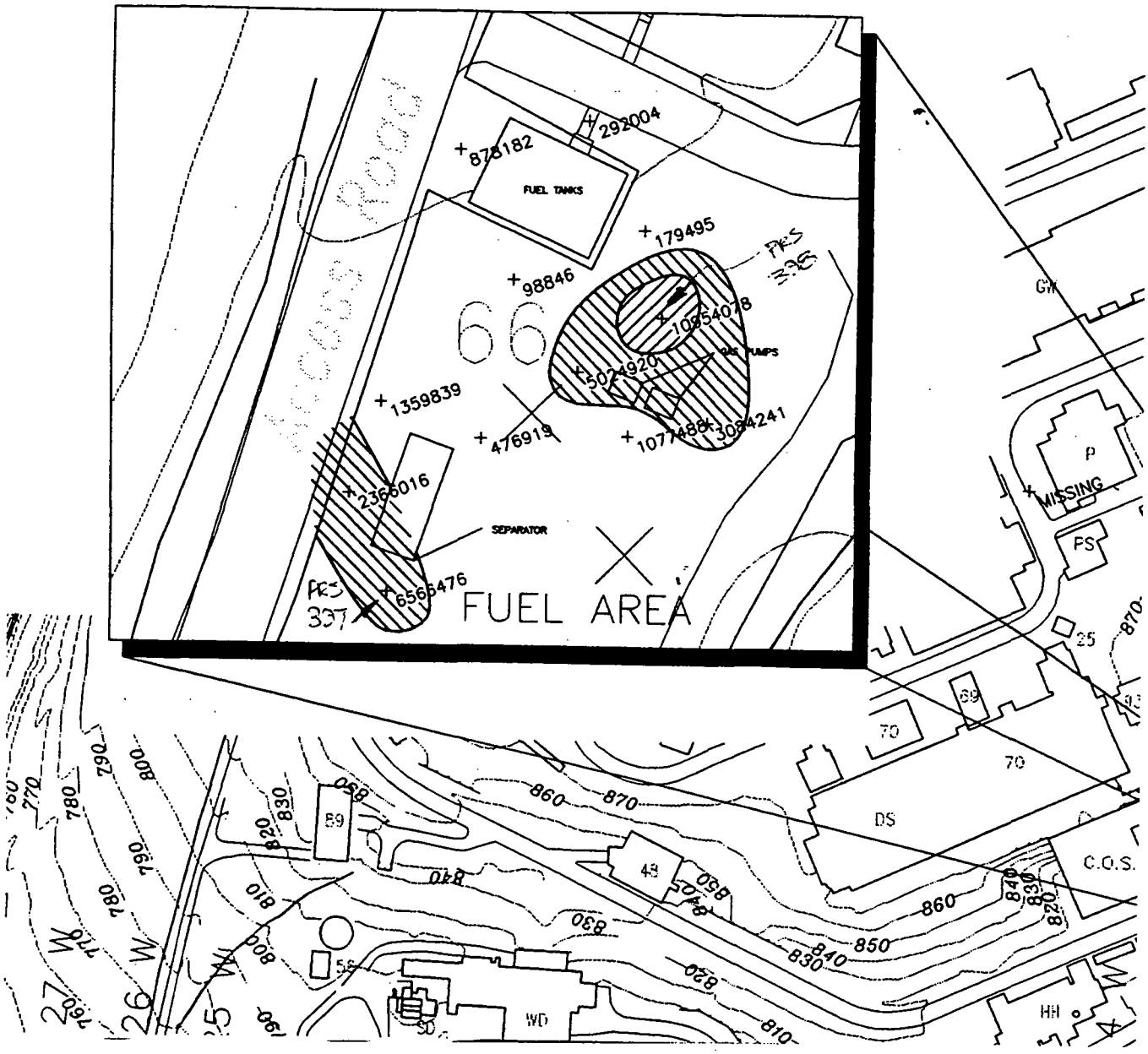




Features:

+ PETREX Sample Location

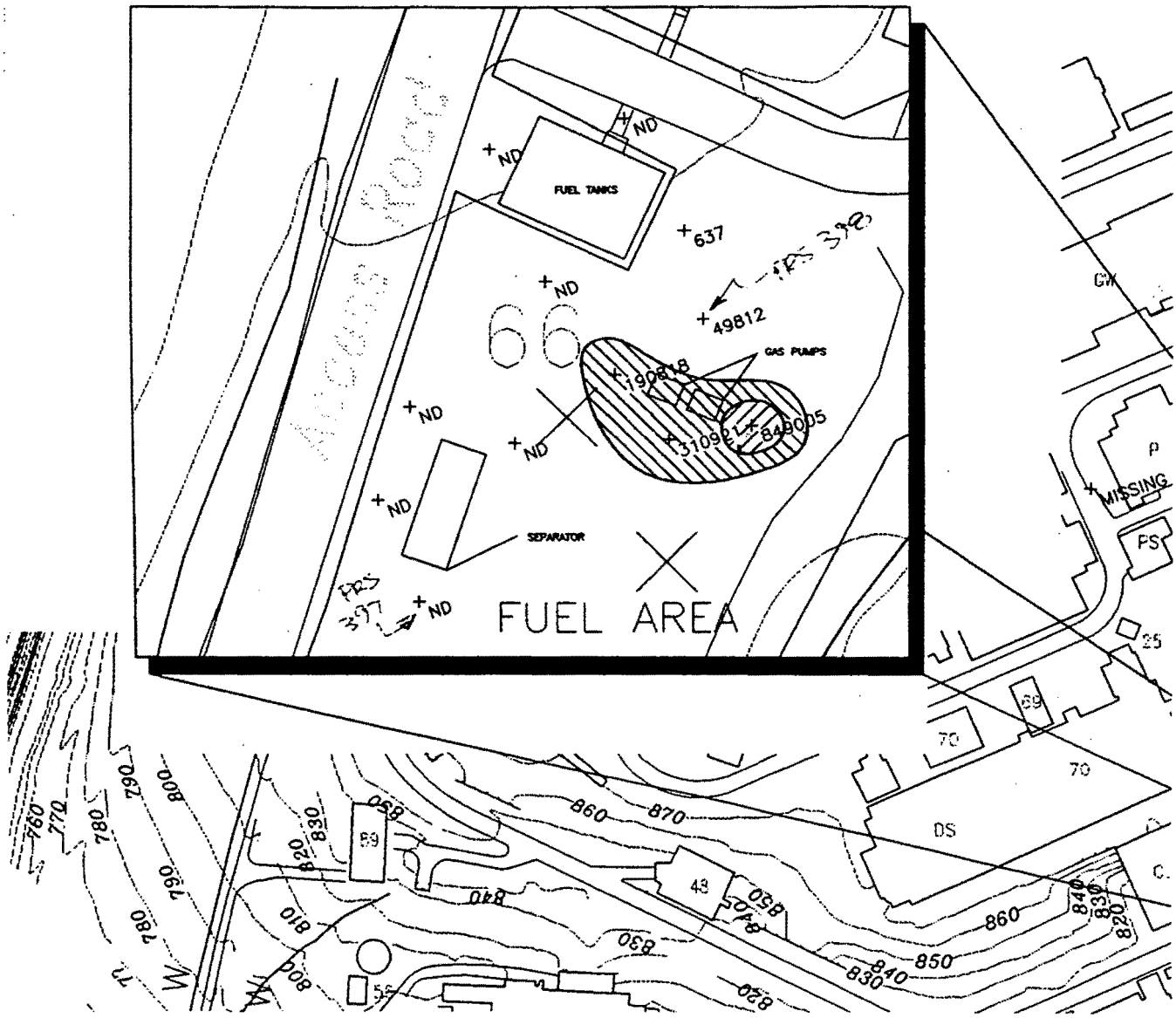
ND Not Detected

T Denotes interference by terpenes; see text.

Relative Response

Total Aromatic Hydrocarbons

Plate 2



Features:

+ PETREX Sample Location

ND Not Detected

Relative Response

Total Semivolatile Hydrocarbons

Plate 3

Features:

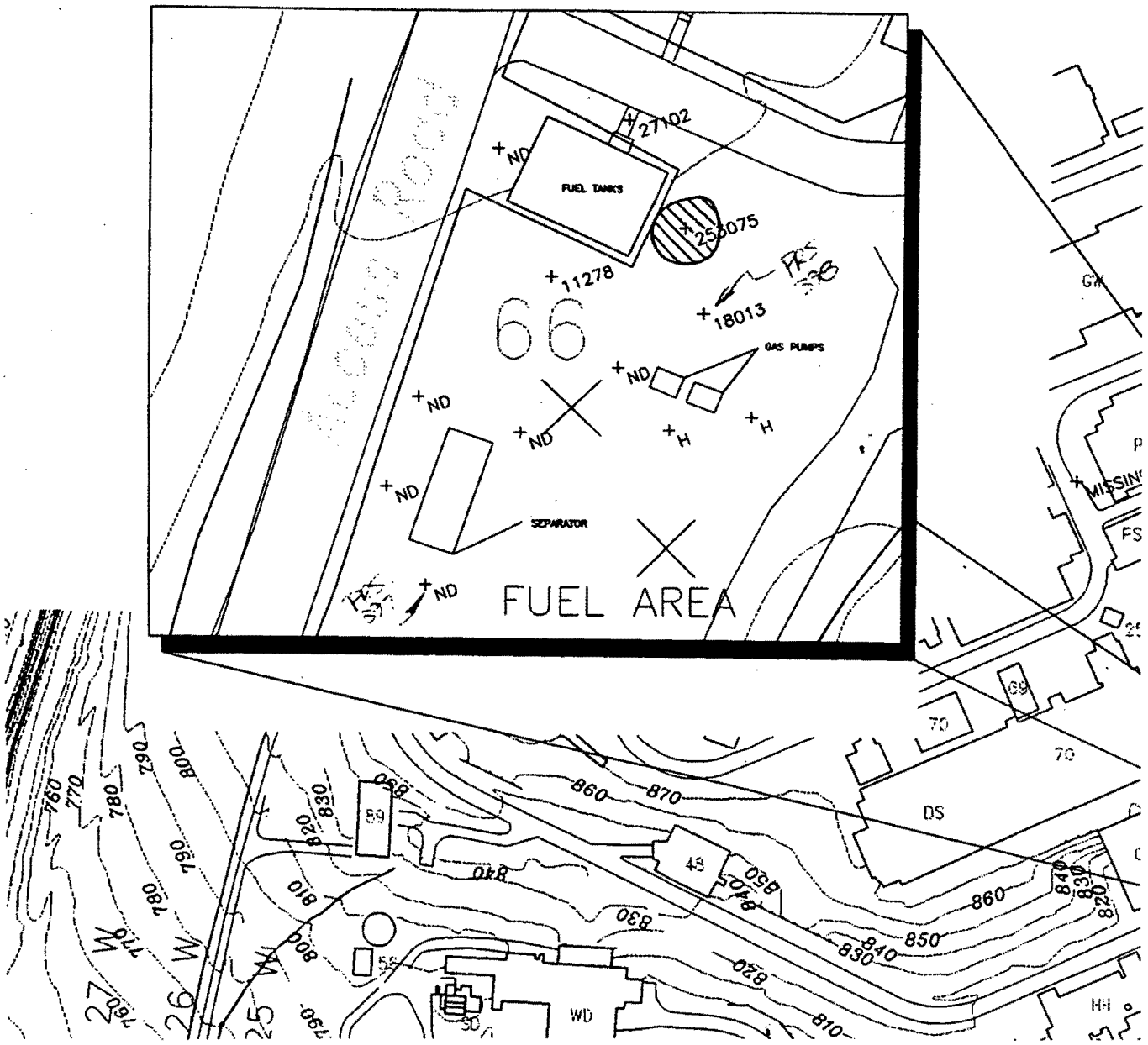
+ PETREX Sample Location

T Denotes interference by terpenes; see text.

Relative Response

Total C5–C11 Petroleum Hydrocarbons

Plate 4



Features:

+ PETREX Sample Location

ND Not Detected

H Denotes interference by petroleum hydrocarbons; see text.

Relative Response

Total Halogenated Hydrocarbons

Plate 5

ENVIRONMENTAL RESTORATION PROGRAM

OPERABLE UNIT 9,
SITE SCOPING REPORT
VOLUME 6 - PHOTO HISTORY REPORT

MOUND PLANT
MIAMISBURG, OHIO

February 1992

DEPARTMENT OF ENERGY
ALBUQUERQUE OPERATIONS OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
TECHNICAL SUPPORT OFFICE
LOS ALAMOS NATIONAL LABORATORY

FINAL

Note: Although this document is an approved Final document, some text may be marked as "Draft" in the footer. This indicates that no changes have been necessary between submission of the Draft, revision, and regulatory agency approval.

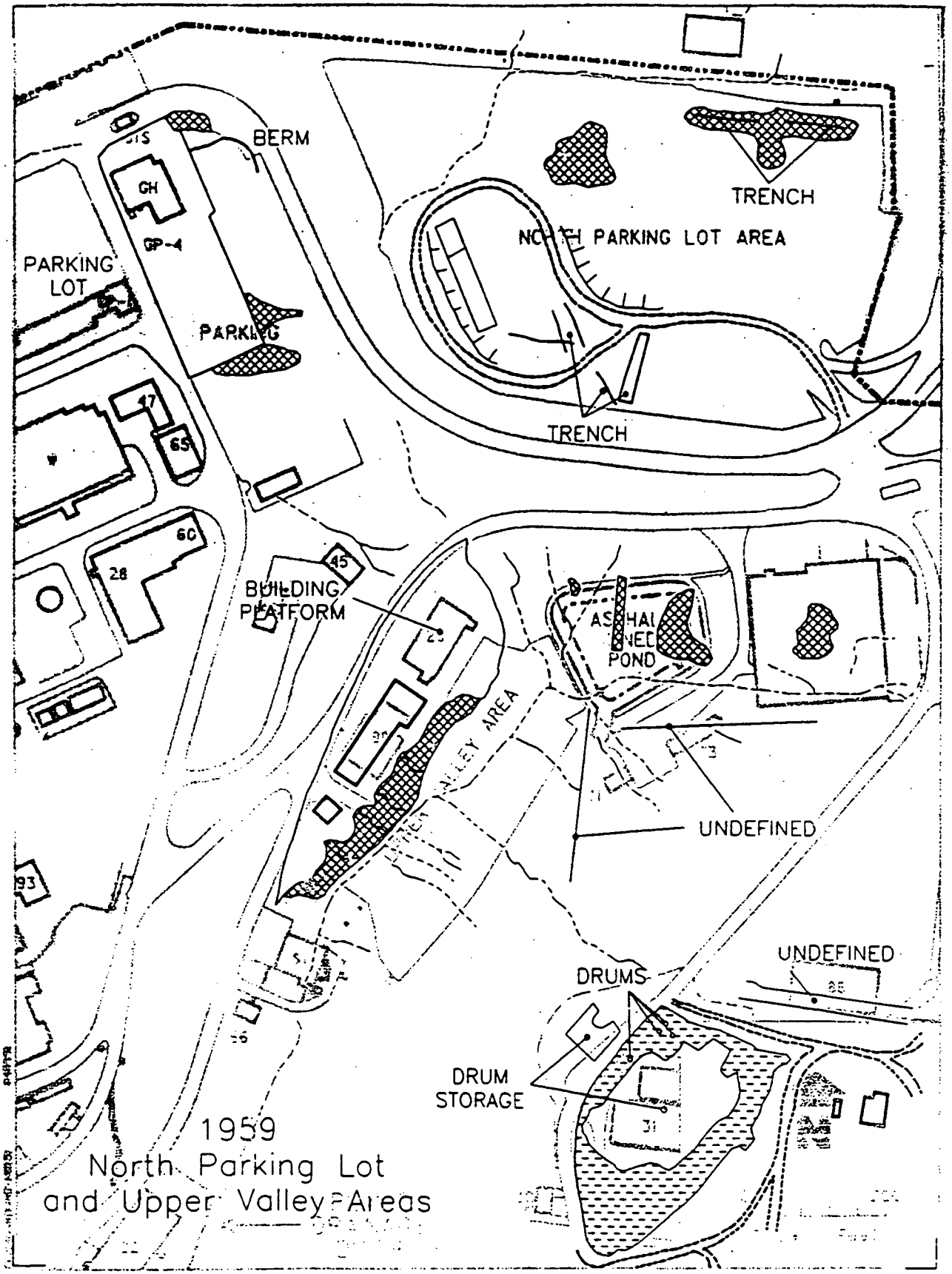


Figure 4.2. Interpretive map of Northern Study Area - 1959.

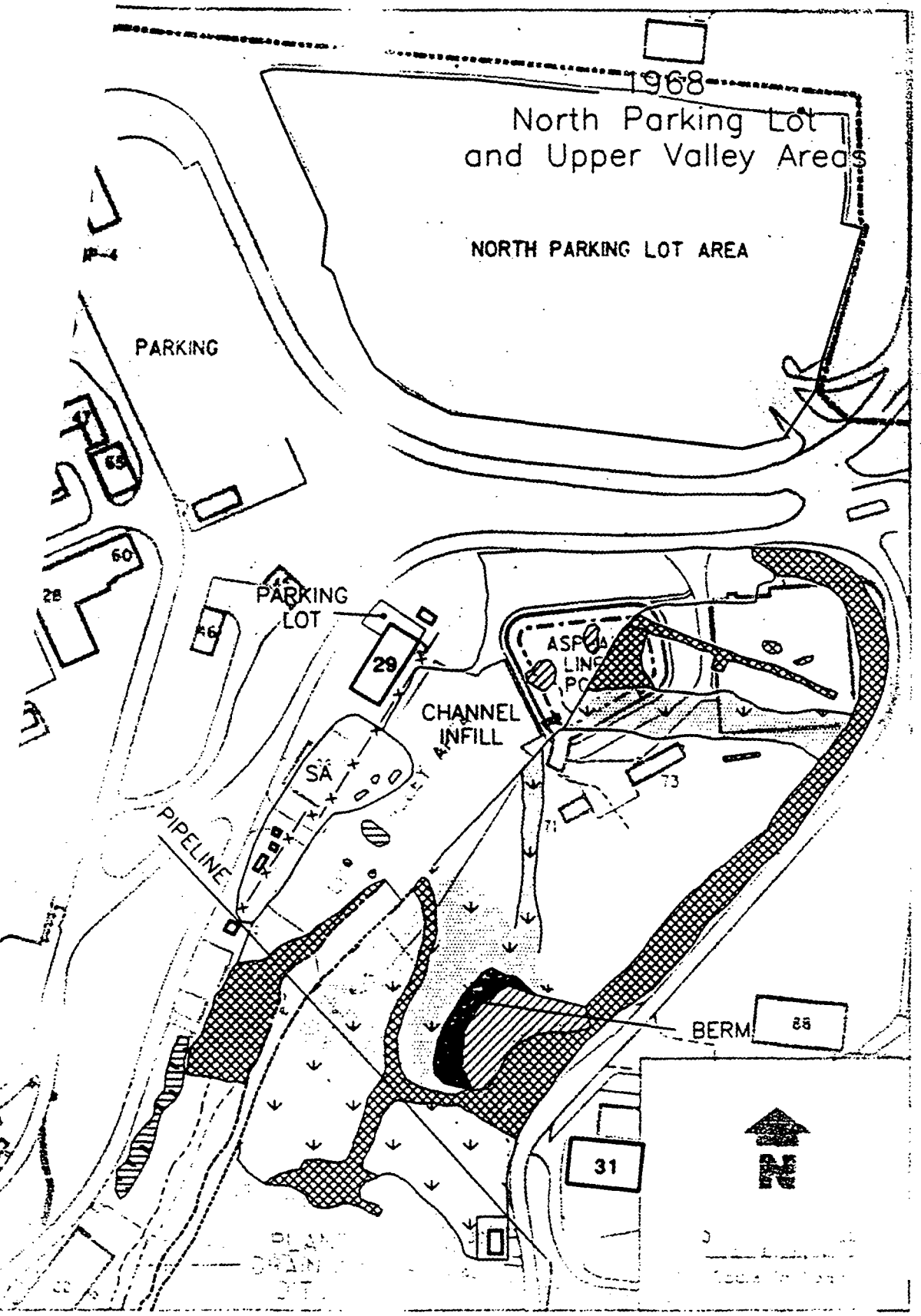


Figure 4.4. Interpretive map of Northern Study Area - 1968.

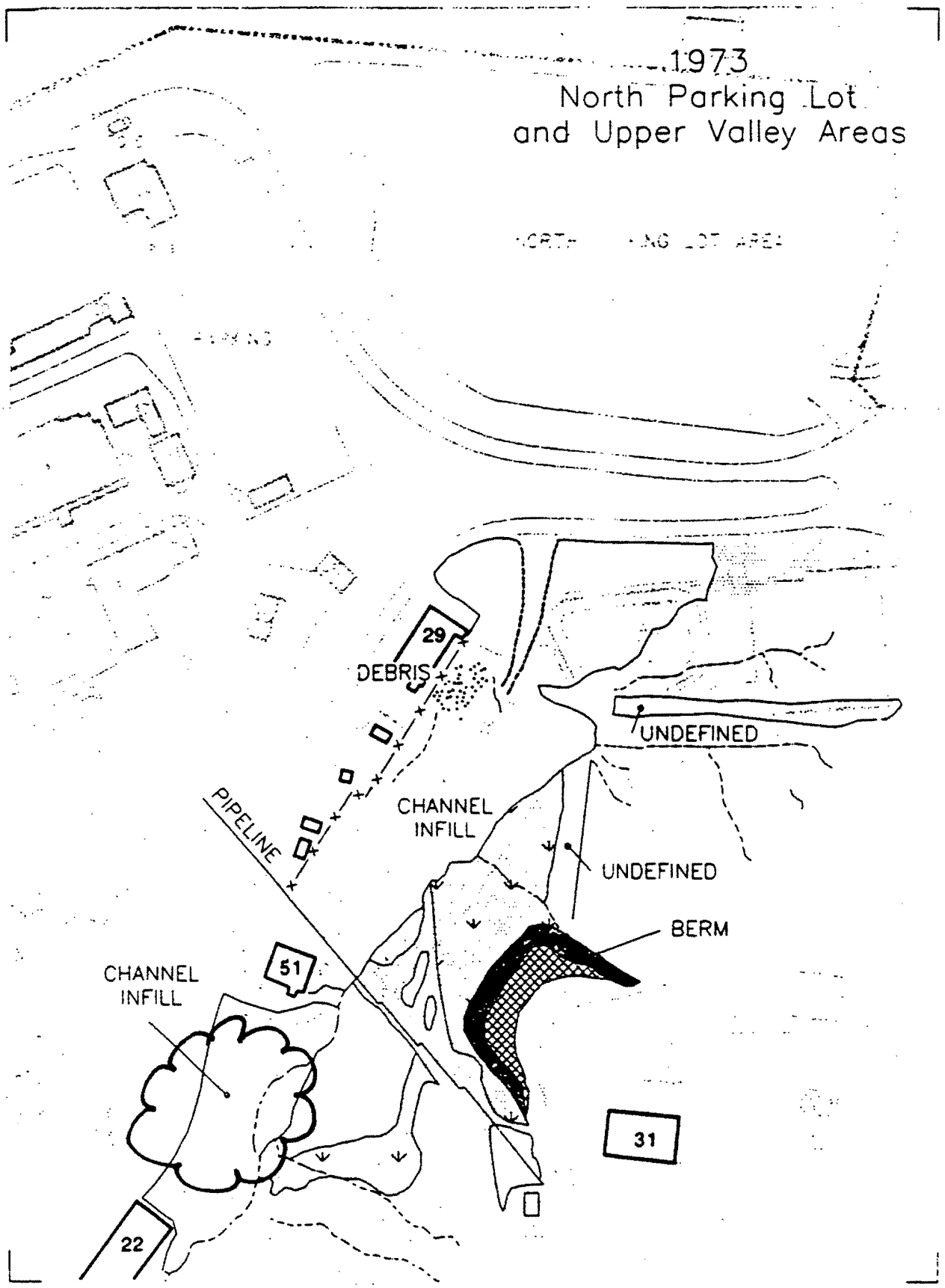


Figure 4.5. Interpretive map of Northern Study Area - 1973.

SOIL GAS SURVEY AND GEOPHYSICAL INVESTIGATIONS
MAIN HILL AND SM/PP HILL AREAS
RECONNAISSANCE SAMPLING

MOUND PLANT
MIAMISBURG, OHIO

February 1993

DEPARTMENT OF ENERGY
ALBUQUERQUE OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
EG&G MOUND APPLIED TECHNOLOGIES

2.15 and 2.16). Trichloroethylene (TCE) was detected at 33 locations ranging from 2 to 34,780 ppb (Figures 2.17 and 2.18). Toluene was detected at 41 locations ranging from 3 to 23,142 ppb (Figures 2.19 and 2.20). Figures 2.21 and 2.22 illustrate the total VOCs detected at each location on the Main Hill.

Some of the trip blanks, ambient blanks, and field blanks collected during the Main Hill investigation contained minor amounts of some of the target compounds. Table II.5 presents the positive blank detections from the Main Hill sampling effort. Neither of the Main Hill groundwater samples contained measurable concentrations of the target compounds.

2.3.2 Old Firing Range Drum Storage Site/Area J

A total of 26 investigative samples were collected and analyzed from the grid at Area J at depths ranging from 5 to 20 feet. All samples initially were collected from a 5-foot depth (samples 3152-3188). Samples 3209 and 3210 were collected as discretionary locations following a review of the geophysical survey data, which showed potential for the burial of ferrous materials below a depth of 10 feet. These samples were collected at depths of 17 and 20 feet near the geophysical anomalies to determine the presence of VOCs at that greater depth. No groundwater was sampled nor encountered during the Area J field effort. Samples 3184 and 3186 could not be collected due to shallow obstructions encountered during probe placement.

Table II.6 summarizes the positive detections from the Area J sampling effort. Five of the eight target compounds were detected. Freon 11 was detected at three locations at concentrations ranging from 2 to 46 ppb (Figure 2.23). The compound 111TCA was detected at two locations ranging from 7 to 37 ppb (Figure 2.24). PCE was detected at one location at 15 ppb (Figure 2.25). TCE was detected at one location at 13 ppb (Figure 2.26). Toluene was detected at three locations ranging from 5 to 11 ppb (Figure 2.27). Figure 2.28 illustrates the total VOCs detected at each location in Area J.

There was one detection of PCE in an ambient blank sample during the Area J sampling effort at a concentration of 6 ppb. Table II.7 describes this blank detection.

2.3.3. Building 51

A total of 18 investigative samples were collected from 10 locations near Building 51. Sampling depths were planned to be 15 and 25 feet at each location, however, two locations were only sampled from 13 to 15 feet due to soil probe refusal. Of the eight locations having 25-foot samples, two were water samples (4159 and 4160).

Table II.8 summarizes the positive detections from the Building 51 area sampling effort. Seven of the eight target compounds were detected in the soil vapor samples. These detections are shown on Figures 2.29 through 2.36. These figures also show Area 7 results. Toluene was the only VOC detected in either of the two water samples. Freon 11 was detected at two locations and three depths at concentrations ranging from 5 to 89 ppb (Figure 2.29). Freon 113 was detected in the 15- and 25-foot samples at one location at 9 and 18 ppb, respectively (Figure 2.30). Cis-12DCE was detected in the 15-foot samples from two locations at concentrations of 8 and 18 ppb (Figures 2.31). 111TCA was detected at two locations and three depths at concentrations ranging from 4 to 37 ppb (Figure 2.32). PCE was detected at three locations and four depths at concentrations ranging from 7 to 44 ppb (Figure 2.33). TCE was detected in the 15- and 25-foot samples at three locations at concentrations ranging from 9 to 207 ppb (Figure 2.34). Toluene was detected at four locations and six depths at concentrations ranging from 0.2 to 37 ppb, however, all but the water sample collected from the 25-foot depth at location 4160 showed associated blank detections (Figure 2.35). Figure 2.36 shows the total VOCs detected at each location near Building 51 (excluding samples with associated blank interferences).

Table II.9 summarizes the blank detections from the Building 51 sampling effort. Two soil gas ambient blanks and one water trip blank contained toluene from 0.1 to 5 ppb.

2.3.4. Area 7

A total of 53 investigative samples were collected from Area 7. All locations were sampled at a 5-foot depth except samples 2211 and 2212, which were contingency samples collected from a 15-foot depth. One of the 5-foot samples was a water sample (2036). Table II.10 summarizes the positive detections from the Area 7 sampling effort. Area 7 detection figures are repeats of the Building 51 figures. Six of the eight target compounds were detected at Area 7. Freon 11 was detected at three locations at concentrations ranging from 7 to 32 ppb (Figure 2.29). Freon 113 was detected at four locations ranging from 4 to 33 ppb (Figure 2.30). CIS-12DCE was detected at two locations ranging from 3 to 10 ppb (Figure 2.31). 111TCA was detected at five locations ranging from 2 to 22 ppb (Figure 2.32). PCE was detected at two locations at 6 and 7 ppb (Figure 2.33). Toluene was detected at 24 locations within Area 7. Eight of the 24 locations had associated blank detections of toluene. Sample 2036 was a water sample, which also showed toluene in its associated field blank. Figure 2.35 illustrates the Area 7 toluene detections that do not have these associated blank detections. Figure 2.36 shows the total VOCs detected at each of the Area 7 sample locations.

TABLE II.8. SUMMARY OF POSITIVE DETECTIONS – BUILDING 51
(ppb)

SAMPLE ID	SAMPLE DATE	FREON 11	FREON 113	TRAN–12DCE	CIS–12DCE	111TCA	PCE	TCE	TOLUENE
~~MND–01–4157–0025w~~	~~29 AUG 92~~	~~---~~	~~---~~	~~---~~	~~---~~	~~---~~	~~---~~	~~---~~	~~0.2 *~~
MND–01–4160–0015	29 AUG 92	---	---	---	8	---	---	---	37 *
~~MND–01–4160–0025w~~	~~30 AUG 92~~	~~---~~	~~---~~	~~---~~	~~---~~	~~---~~	~~---~~	~~---~~	~~0.28~~
MND–01–4161–0015	29 AUG 92	---	---	---	---	---	---	9	8 *
MND–01–4161–1025	29 AUG 92	---	---	---	---	---	7	19	---
MND–01–4166–0015	31 AUG 92	5	9	---	---	---	44	75	---
MND–01–4166–0025	31 AUG 92	---	18	---	---	4	44	56	---
MND–01–4167–0015	31 AUG 92	89	---	---	18	37	44	207	8 *
MND–01–4167–0025	31 AUG 92	36	---	---	---	11	---	169	8 *

Notes:

Only sample locations having positive detections are shown.
*: Associated trip, ambient, equipment or field blank contained specified compound.
B: Indicates blank sample.
w: Indicates water sample.

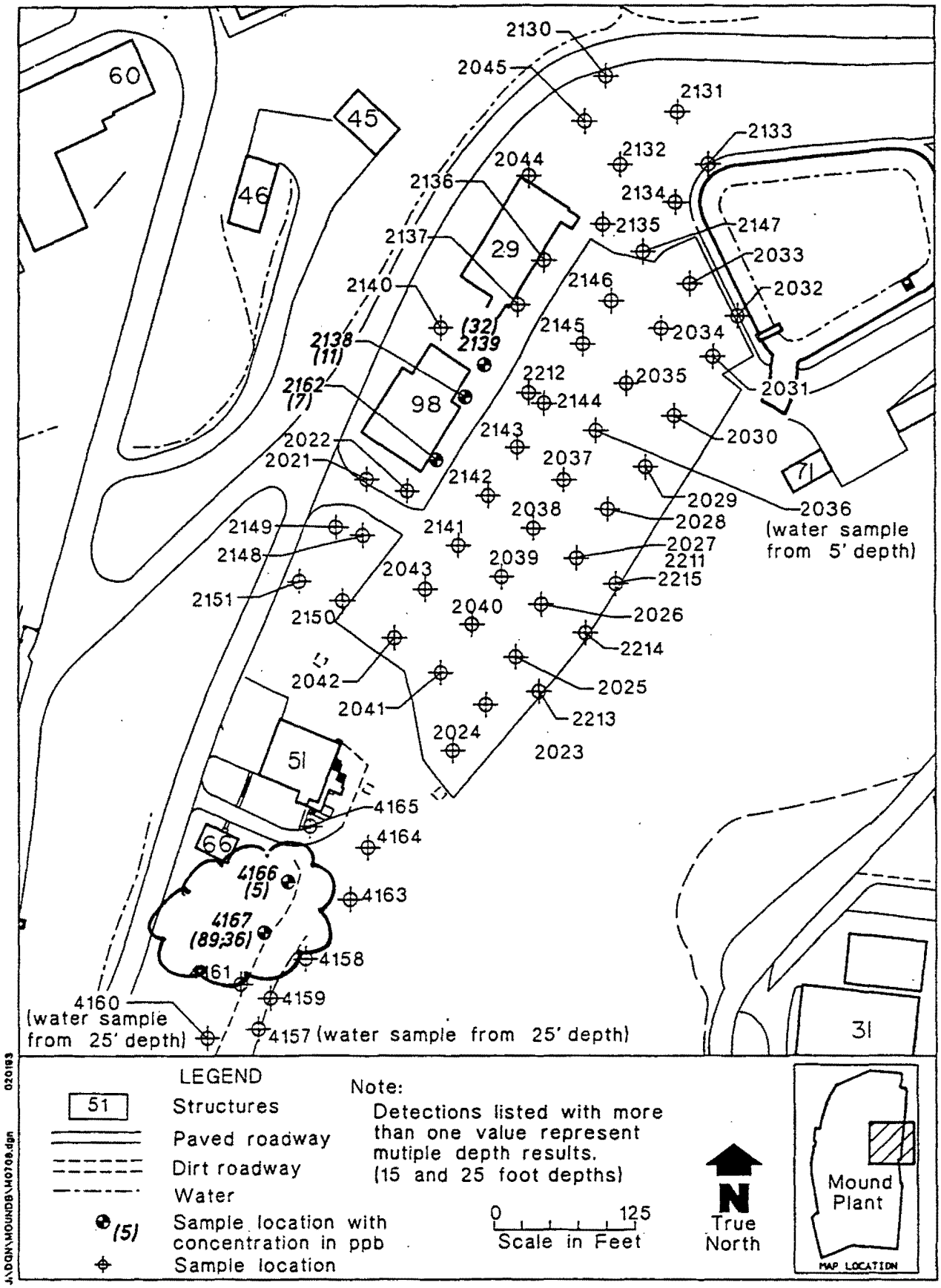


Figure 2.29. Freon II detection map for Area 7 and Building 51.

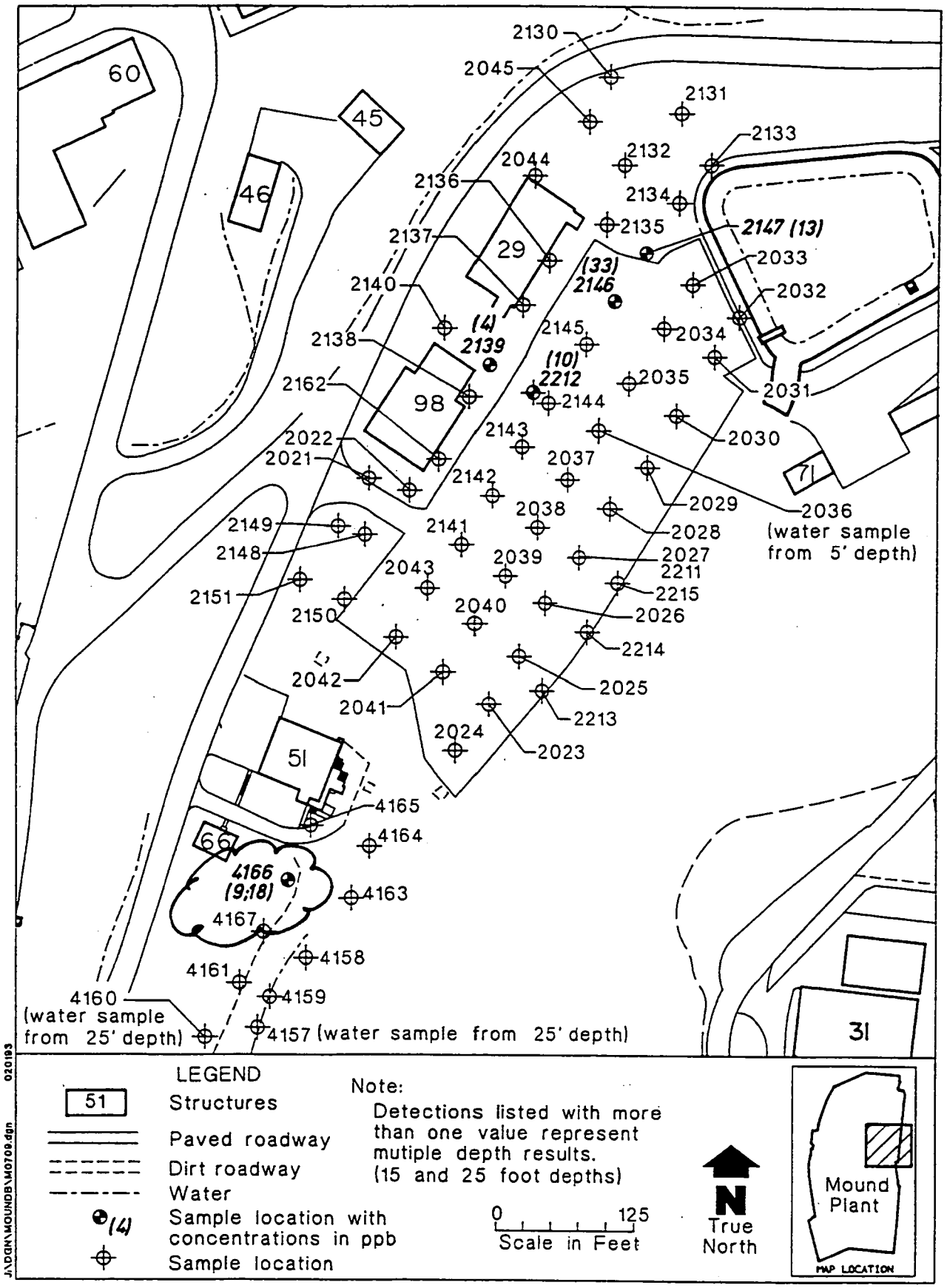


Figure 2.30. Freon 113 detection map Area 7 and Building 51.

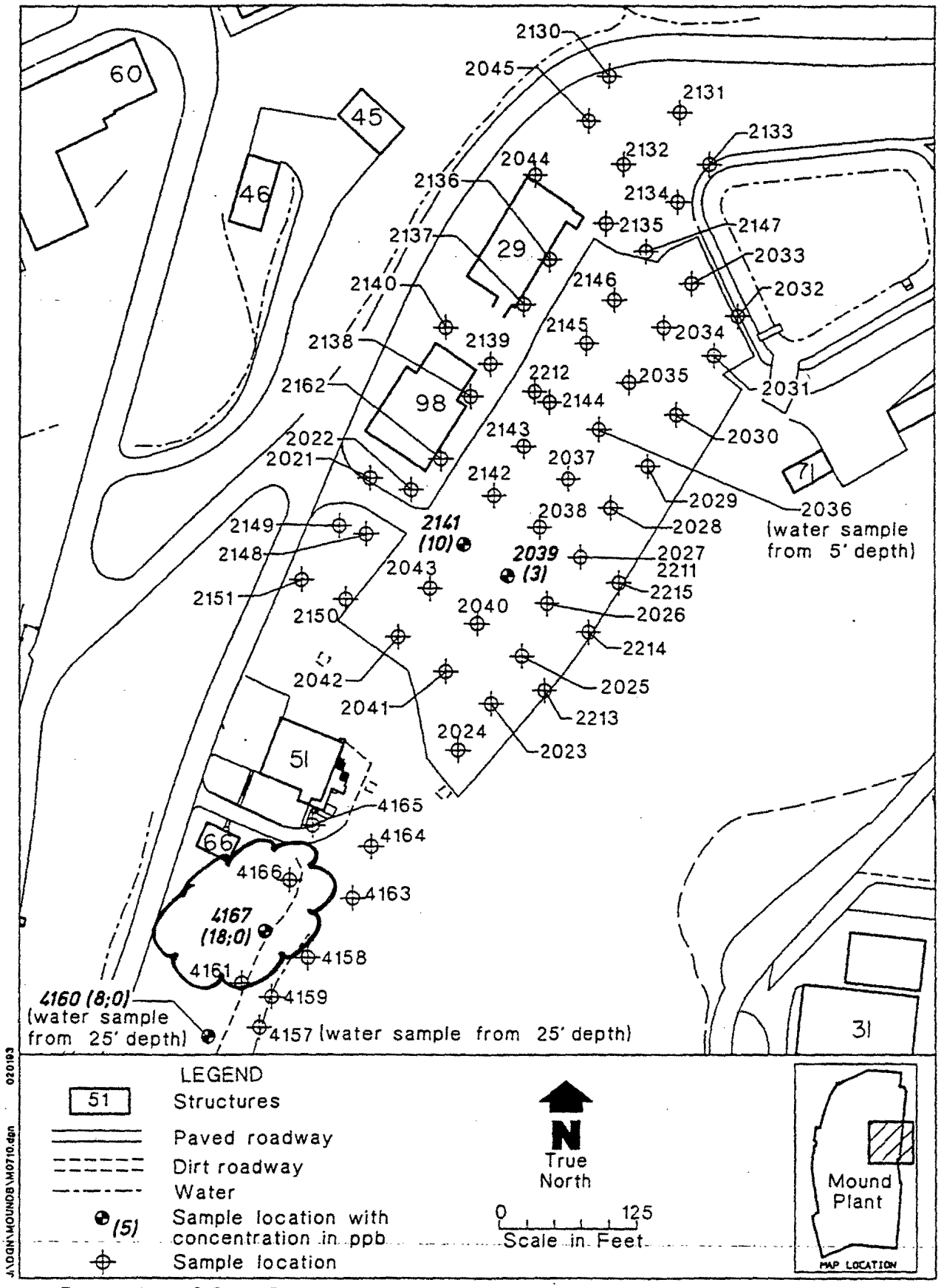


Figure 2.31. CIS-1,2-Dichloroethene detection map for Area 7 and Building 51.

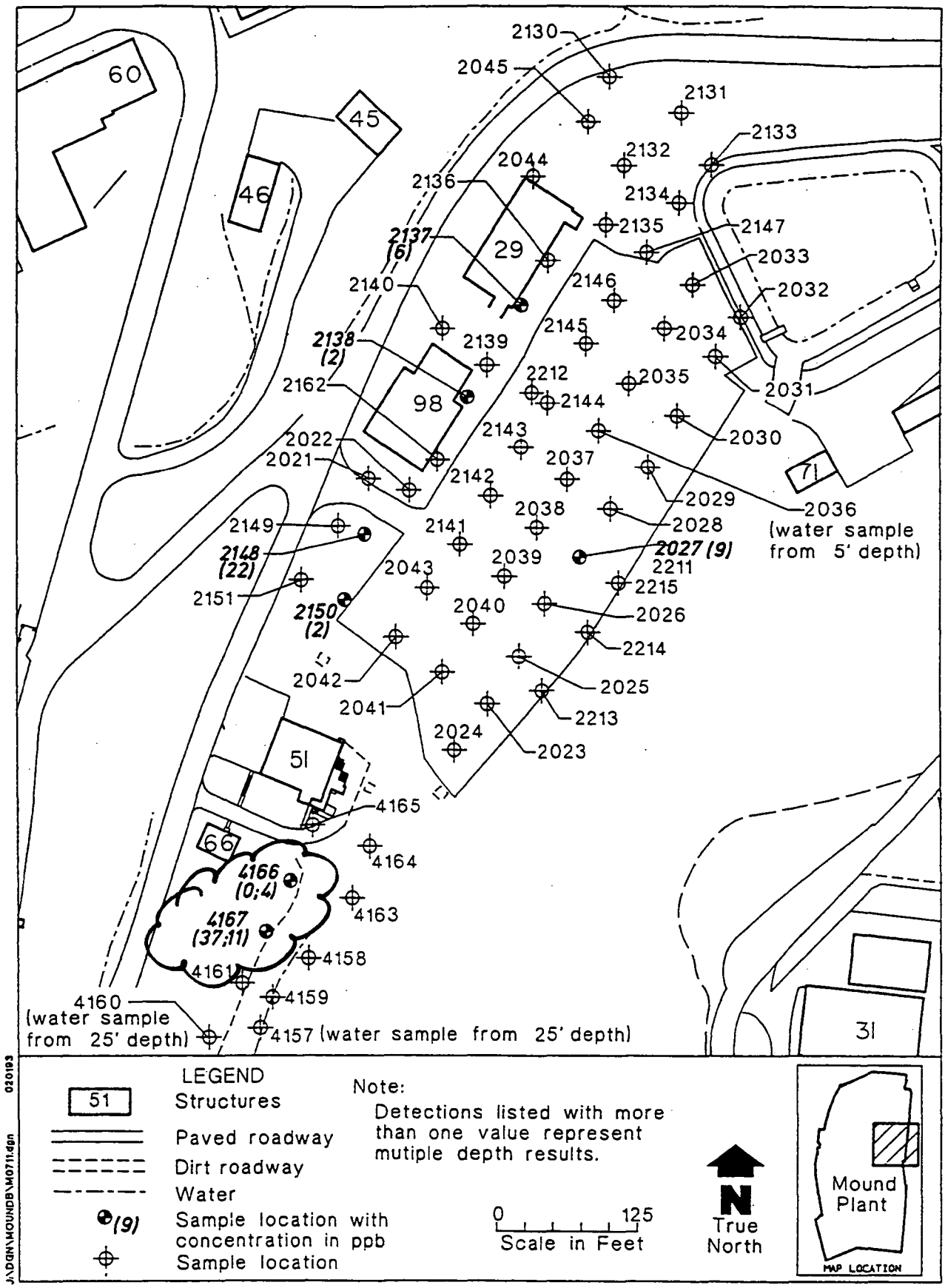


Figure 2.32. 1,1,1-Trichloroethane detection map for Area 7 and Building 51.

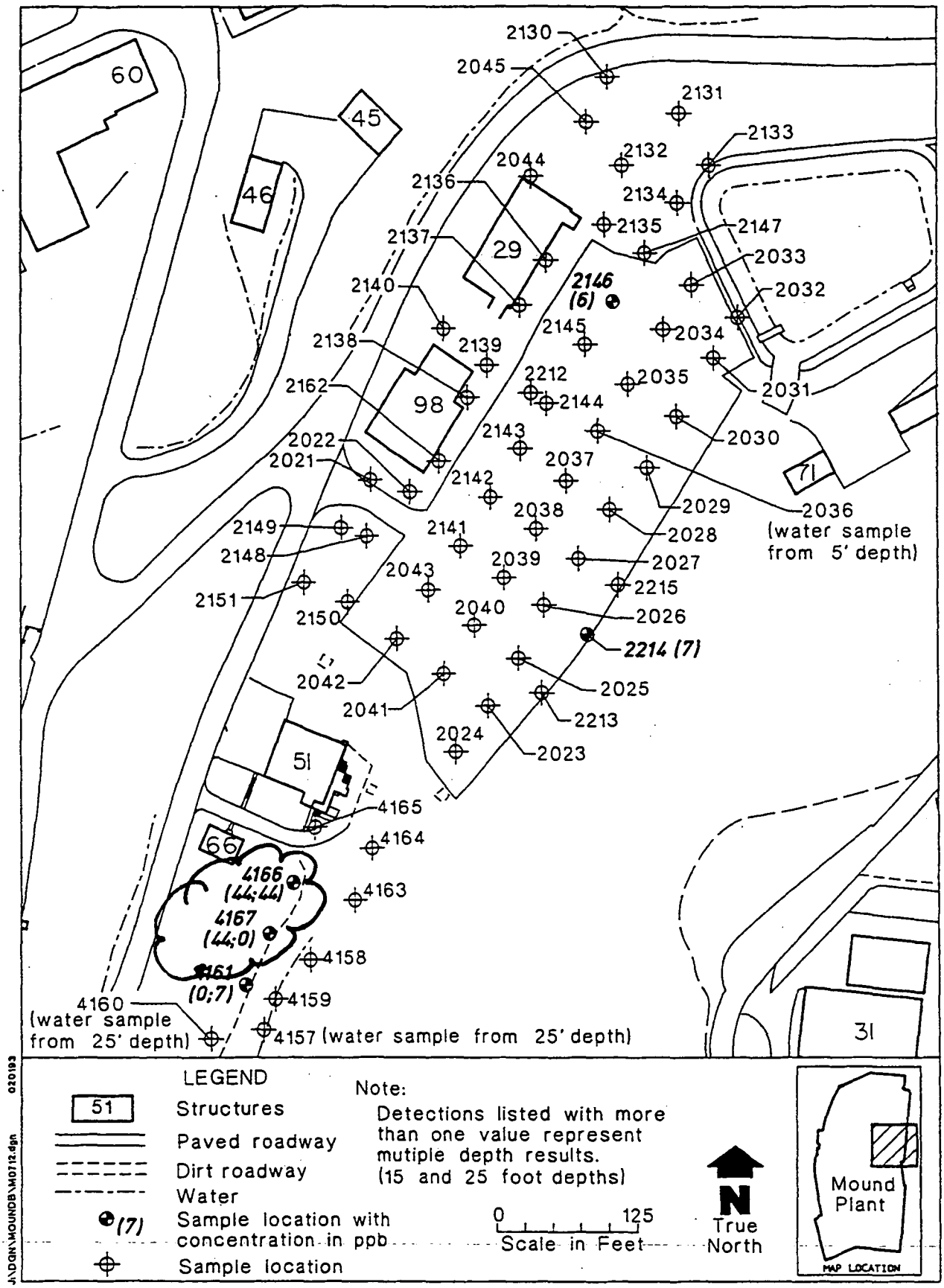


Figure 2.33. Tetrachloroethene detection map for Area 7 and Building 51.

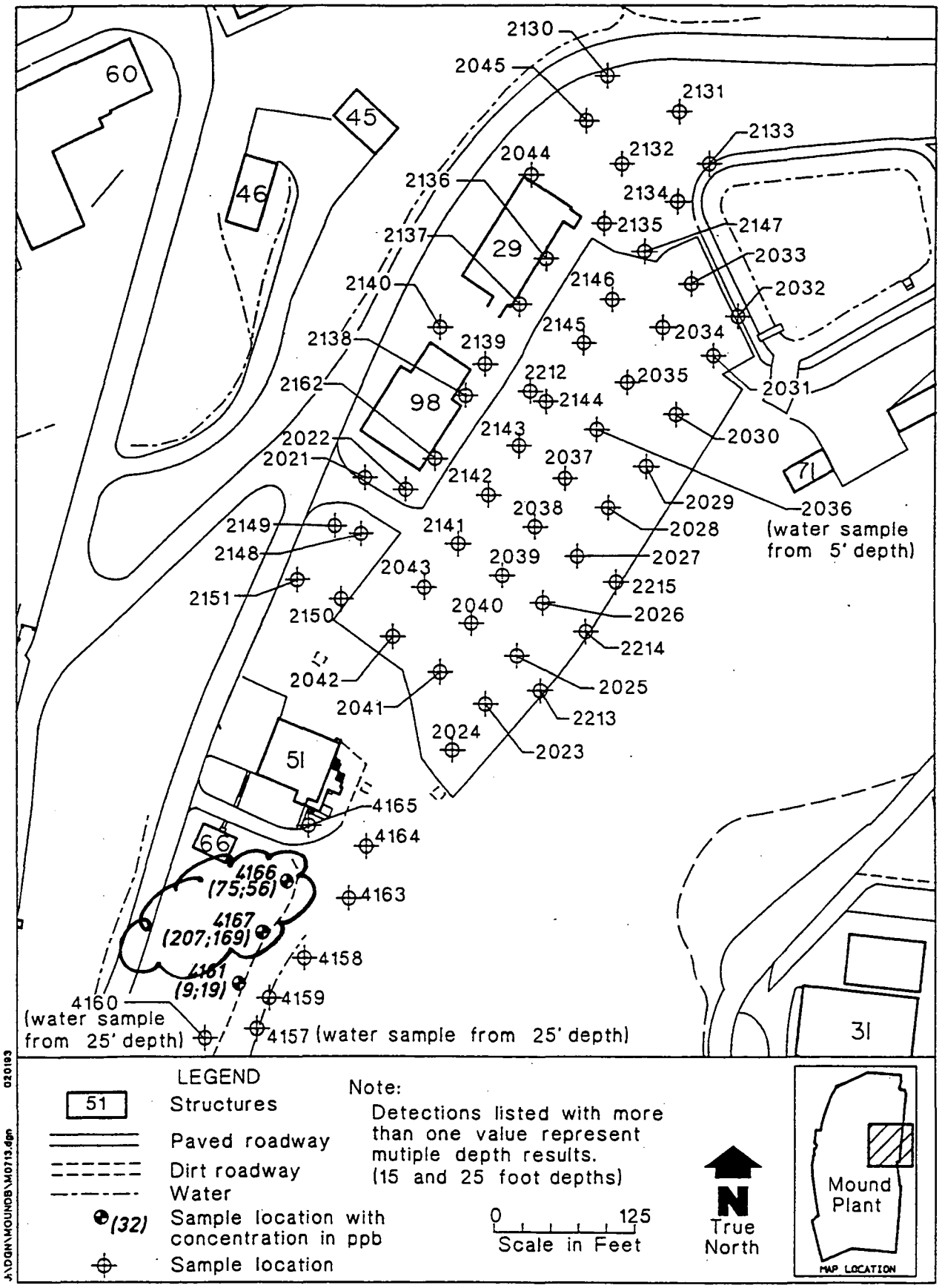


Figure 2.34. Trichloroethene detection map for Area 7 and Building 51.

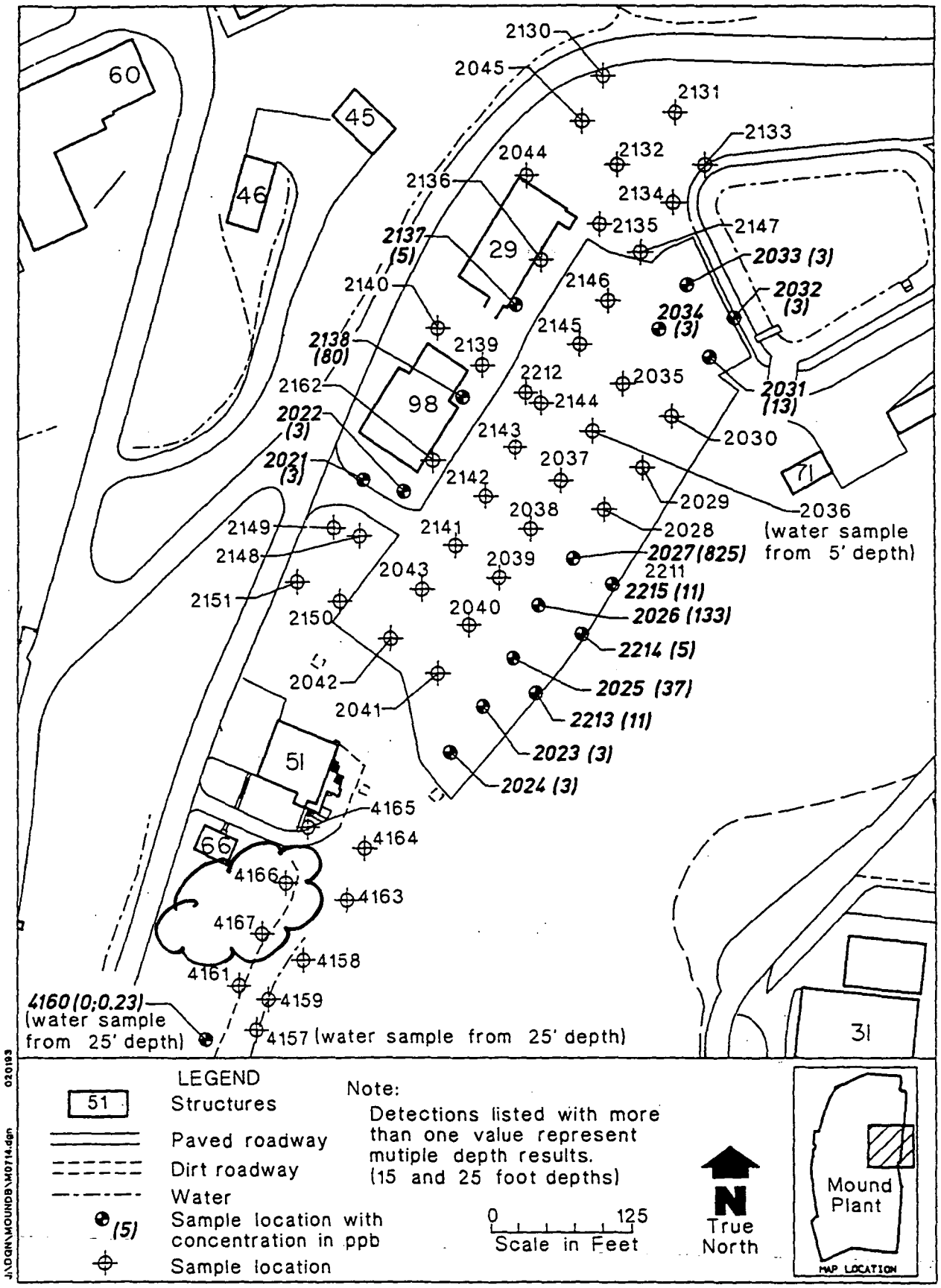


Figure 2.35. Toluene detection map for Area 7 and Building 51.

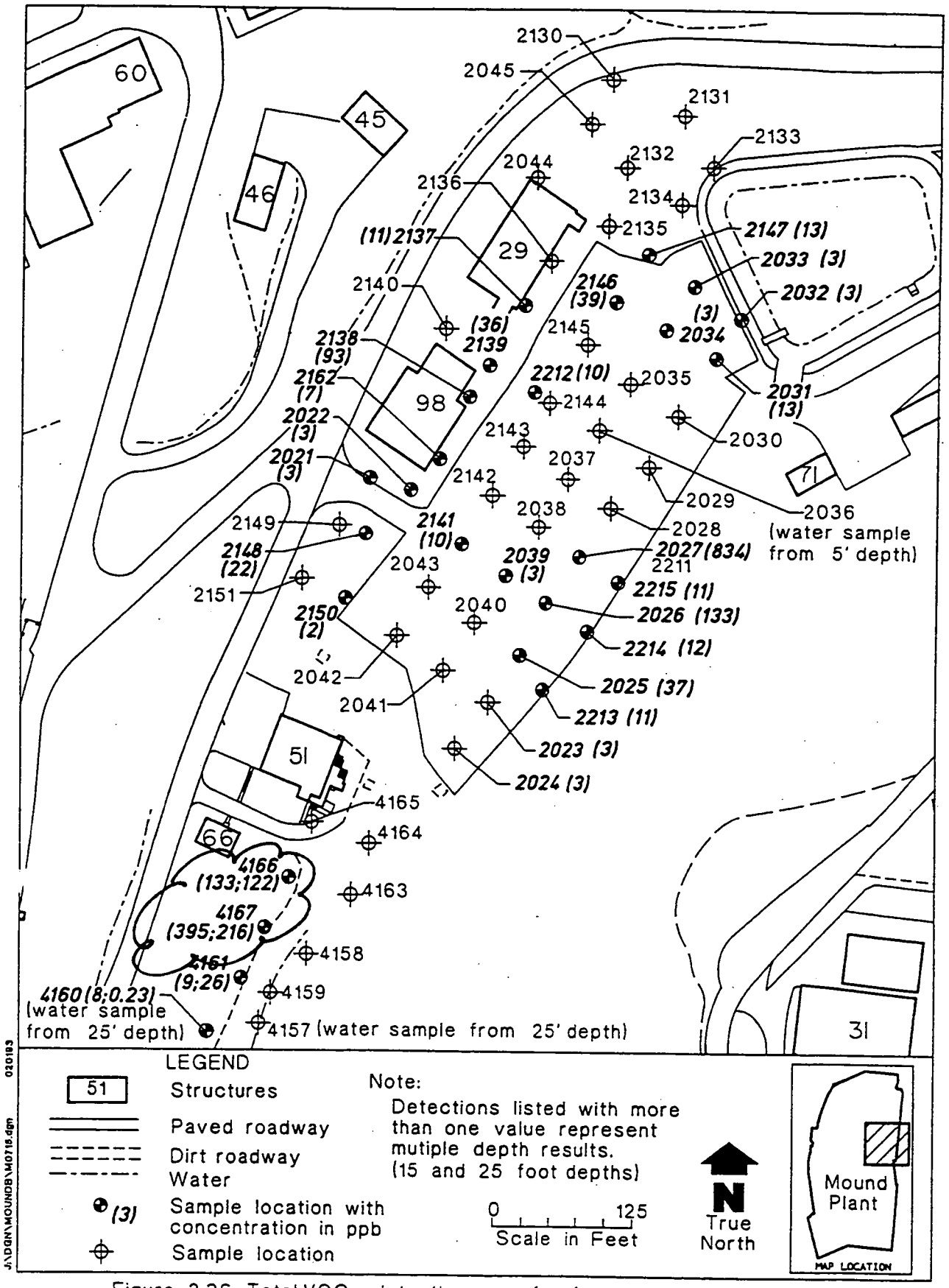


Figure 2.36. Total VOCs detection map for Area 7 and Building 51.

COMPARISON OF ACTUAL SOIL GAS VALUES WITH CALCULATED ACCEPTABLE SOIL GAS VALUES

SCREENING POTENTIAL RELEASE SITES BASED ON SOIL GAS READINGS

Soil gas readings can be utilized in the PRS screening process to identify potential release sites that may present a potential soil contamination problem for volatile organics. The soil gas survey that was conducted at Mound as part of the "Reconnaissance Sampling Report--Soil Gas Survey and Geophysical Investigations, Mound Plant Main Hill and SM/PP Hill" investigated 8 volatile compounds. The concentrations of these compounds in the in the vapor phase within the pore spaces of the soil can be correlated to the actual soil contaminant concentrations by utilizing a method developed by ICF Kaiser Engineers. This technique has been used with US EPA Region IX approval at a large Superfund site contaminated with many of the same chemicals found at relatively low levels in soils at the Mound Plant.

The soil concentration can be estimated from the soil gas values by the following equation:

$$Ct = (Cg/Pb)*[[Pb * Kd / H] + [pw / H] + [pt - pw]]$$

where

Cg	concentration of volatile chemical concentrations as soil vapor in ng/ml
Pb	Bulk density of the soil in g/ml
Kd	soil/water partition coefficient in ml/g
H	Dimensionless Henry's Law Constant
pw	water filled porosity
pt	total porosity
Ct	target soil concentration in ng/g or ug/kg (ppb)

The technique that Mound Plant will use for screening a PRS is to compare the soil gas values obtained at a PRS with soil gas concentrations that are known to be below any regulatory or health based level of concern. The risk based guideline values for the Mound Plant (DOE, December 1995) soils are based upon 10^{-6} risk levels or a hazard index of 1. These values correspond to direct soil exposure to persons who's activities place them at the highest risk, in particular inhalation and ingestion by a Mound Plant construction worker.

Another potential exposure path must be considered, however. The potential for some of the organic contaminants to leach into ground water must be considered in developing protective soil screening levels. A "Mound Plant Soil Screening Level" paper explains the calculation of soil screening levels. For all of the chemicals that the soil gas survey identified, the calculated soil screening level soil concentrations are below the standard guideline values, therefore they are more conservative and are appropriate to be used as the basis for the soil gas calculations.

By re-arranging the equation, and using either the soil guideline values or the soil screening levels as the target soil concentration, a soil gas concentration can be calculated; this calculated soil gas concentration can be compared to the actual observed soil gas values:

$$Cg = (Pb*Ct)/[[Pb*Kd/H] + [pw/H] + [pt-pw]]$$

The values of the soil specific and chemical parameters for this equation are summarized as follows:

Pb	1.6	Bulk density of the soil in g/ml
pw	0.15	water filled porosity
pt	0.43	total porosity
foc	0.02	fraction organic material in soil (used in developing the SSL values)

Typical chemicals that are detected with soil gas sampling are:					
NAME	H	Kd	Calculated Acceptable	Calculated Acceptable	Calculated Acceptable
			Soil Screening Level Value	Soil Gas Reading	Soil Gas Reading
		ml/g	mg/kg (ppm)	ng/ml	ppb
Toluene	2.52E-01	3.42	22.06	1.56E+03	414600
Trichloroethene (TCE)	4.35E-01	2.24	0.07	1.26E+01	2400
111 Trichloroethane (TCA)	7.63E-01	2.2	3.01	9.46E+02	173400
Trans-1,2 Dichloroethene (DCE)	2.29E-01	1	0.70	1.41E+02	35700
cis-1,2 Dichloroethene (DCE)	1.85E-01	2.78	0.31	1.97E+01	5000
Freon 11	NA	NA			
Freon 113	NA	NA			
Tetrachloroethene (PCE)	7.09E-01	2.78	0.09	2.13E+01	3100

na not available

IF THE SOIL GAS READING IS BELOW THE VALUES IN THE CALCULATED SOIL GAS READING COLUMN (SHADED), THEN THERE IS NO THREAT TO GROUNDWATER FROM THIS PRS.

The soil screening level values are calculated using the Soil Screening Methodology. The Potential Release Site is assumed to be more than 100 meters from a potential drinking water source with an aquifer thickness of 15 meters and a source size of 10 meters. The hydraulic gradient is assumed to be 0.01 which is conservative for most of the Mound Plant PRSs. In special instances where the PRS lies less than 100 meters from a potential drinking water source, or the hydraulic gradient is much less than 0.01, new SSL values and new acceptable soil gas values will be calculated for that particular PRS.

MOUND

Environmental
Restoration
Program

Further Assessment

Soil Gas Confirmation Sampling

Mound Plant
Miamisburg, Ohio

May 1996

Revision 0

Department of Energy

EG&G Mound Applied Technologies

Table I.1 Soil Analyte List

Volatile Organic Compounds

Acetone	Dibromochloromethane	4-Methyl-2-Pentanone
Benzene	1,1-Dichloroethane	Styrene
Bromodichloromethane	1,2-Dichloroethane	1,1,2,2-Tetrachloroethane
Bromoform	1,1-Dichloroethene	Tetrachloroethene
Bromomethane	1,2-Dichloroethene (total)	1,1,1-Trichloroethane
2-Butanone	1,2-Dichloropropane	1,1,2-Trichloroethane-
Carbon Disulfide	cis-1,3-Dichloropropene	Trichloroethene
Carbon Tetrachloride	trans-1,3-Dichloropropene	Toluene
Chlorobenzene	Ethylbenzene	Vinyl Acetate
Chloroethane	2-Hexanone	Vinyl Chloride
Chloroform	Methylene Chloride	Xylenes (total)
Chloromethane		

Semivolatile Organic Compounds

Acenaphthene	Chrysene	Hexachlorobenzene
Acenaphthylene	Dibenz(a,h)anthracene	Hexachlorobutadiene
Anthracene	Dibenzofuran	Hexachlorocyclopentadiene
Benzo(a)anthracene	1,2-Dichlorobenzene	Hexachloroethane
Benzo(a)pyrene	1,3-Dichlorobenzene	Indeno(1,2,3-cd)pyrene
Benzo(b)fluoranthene	1,4-Dichlorobenzene	Isophorone
Benzo(g,h,i)perylene	3,3-Dichlorobenzidine	2-Methylnaphthalene
Benzo(k)fluoranthene	2,4-Dichlorophenol	2-Methylphenol
bis(2-Chloroethoxy)methane	Diethylphthalate	4-Methylphenol
bis(2-Chloroethyl)ether	2,4-Dimethylphenol	Naphthalene
bis(2-Ethylhexyl)phthalate	Dimethyphthalate	2-Nitroaniline
4-Bromophenyl-phenylether	Di-n-butylphthalate	3-Nitroaniline
Butylbenzylphthalate	Di-n-octylphthalate	4-Nitroaniline
Carbazole	4,6-Dinitro-2-methylphenol	Nitrobenzene
4-Chloroaniline	2,4-Dinitrophenol	2-Nitrophenol
4-Chloro-3-methylphenol	2,4-Dinitrotoluene	4-Nitrophenol
2-Chloronaphthalene	2,6-Dinitrotoluene	N-Nitroso-di-n-propylamine
2-Chlorophenol	Fluoranthene	N-Nitroso-diphenylamine
4-Chlorophenyl-phenylether	Fluorene	2,2-oxybis(1-Chloropropane)
Pentachlorophenol	Pyrene	2,4,5-Trichlorobenzene
Phenanthrene	1,2,4-Trichlorobenzene	2,4,6-Trichlorobenzene
Phenol		

Table I.1 Soil Analyte List (Continued)

Pesticides/PCB's		
Aroclor-1016	Delta-BHC	Endosulfan II
Aroclor-1221	Gamma-BHC	Endosulfan sulfate
Aroclor-1232	alpha-Chlordane	Endrin
Aroclor-1242	gamma-Chlordane	Endrin aldehyde
Aroclor-1248	4,4'-DDD	Endrin ketone
Aroclor-1254	4,4'-DDE	Heptachlor
Aroclor-1260	4,4'-DDT	Heptachlor epoxide
Aldrin	Dieldrin	Methoxychlor
Alpha-BHC	Endosulfan I	Toxaphene
Beta-BHC		
Inorganics		
Aluminum	Copper	Potassium
Antimony	Cyanide	Selenium
Arsenic	Iron	Silver
Barium	Lead	Sodium
Beryllium	Lithium	Thallium
Bismuth	Magnesium	Tin
Cadmium	Manganese	Vanadium
Calcium	Mercury	Zinc
Chromium	Molybdenum	Nitrate/Nitrite
Cobalt	Nickel	Explosives (USATHAMA,PETN)
Radionuclides		
Americium-241	Plutonium-238	Thorium-230
Bismuth-207	Plutonium-239/240	Thorium-232
Bismuth-210	Potassium-40	Uranium-234
Cesium-137	Radium-226	Uranium-235
Cobalt-60	Thorium-228	Uranium-238

1.2. SAMPLE NUMBERING SCHEME

The sample identification numbers were assigned by Mound to each location in the following format: XXX-AAA-######. For each location, the first three characters were SGC, identifying the sample as part of the soil gas confirmation study. The next three characters represented the area from which each sample was taken:

A03 = Area 3
A07 = Area 7
A13 = Area 13
A21 = Area 21
A22 = Area 22
SDB = Area SDB
AOJ = Area AOJ
NAC = Non-AOC areas (Area of Concern)
SAN = Sanitary area

The final six digits were a sequential number beginning with 000001. The samples related to this study begin with 000001 and end with 000102. Due to an error in surveying, samples 000099 and 000100 were taken from the wrong locations. The sites were resurveyed and the samples were taken again, renamed as 000101 and 000102. No other problems arose with the sample identification.

1.3 SURVEYING

Prior to this sampling event, surveying relocated each of the 100 sites based on coordinates from a previous soil gas sampling event. Surveyors from Barge, Waggoner, Sumner and Cannon, of Miamisburg, Ohio, completed the task, using a benchmark map of approximately 50 locations with state plane coordinates provided by EG&G. Each point was relocated with an accuracy of ±6 inches and identified with either a 3-foot stake with orange flagging tape and the sample identification number or a pin driven into the ground through orange flagging with the sample identification number written on the flagging. The surveyed sampling locations are shown on Figure 1.1.

1.4 UTILITIES CLEARANCE/VARIANCES

After surveying, all sites were checked for the presence of underground utilities by EG&G personnel. The requirement states that sample sites must be located five feet or more from utilities. Situations in which the 5-foot rule was not met were handled in one of three ways: 1) **relocations** - sample sites were placed 5 feet or more from utility markings and normal sampling procedures were followed; 2) **hand-digging** - the VOC sample soil was collected using the core sampler, which was driven only to the depth necessary to collect the VOC sample, and the remaining soil was collected using a hand auger; or 3) **variances to the 5-foot clearance requirement** - some sites were located near visible utilities, so after safe clearance was established, normal sampling procedures were followed. Alternatively, some locations had underground utilities at relitivley deeper depths. At these locations, normal sampling procedures were followed except that digging/coring was limited to two feet instead of the established three feet. No utilities were damaged during the sampling event.

Some locations had no utility interference but still could not be sampled to three feet due to "refusal"--an inability to drive the sampler deeper. This usually indicates that bedrock or large gravel has been reached. In such cases, multiple shallow cores were taken.

A complete list of sites with variances to the original soil gas sampling location or depth can be found in Table I.2.

1.5 SOIL SAMPLING METHODOLOGY

Soil was collected at each location using either a van-mounted Geoprobe® rig equipped with a core sampler, an electric hammer equipped with a core sampler, or a hand auger. The device chosen depended upon the particulars of the location. Acetate liners were used in the Geoprobe® core barrel and the hand-held core sampler. The liners were cut open with utility knives, using a new blade at each site.

Table I.2. Variance From 3-Foot Sampling Depth Specification

Location	Description of Variance
SGC-NAC-000001	Core sampler hit refusal at 2 feet.
SGC-NAC-000002	Relocated due to utilities.
SGC-NAC-000003	Core sampler hit refusal at 2 feet.
SGC-NAC-000004	Core sampler hit refusal at 18 inches.
SGC-NAC-000005	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-NAC-000006	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-NAC-000007	Core sampler hit refusal at 18 inches.
SGC-NAC-000008	Drilled to 2 feet due to utilities.
SGC-NAC-000010	Drilled to 1 foot; hand-augered rest due to utilities; flag against building, so sample taken 6 feet from flag.
SGC-NAC-000012	Drilled to 2 feet due to utilities.
SGC-SAN-000018	Core sampler hit refusal at 2 feet; relocated from inside clarifier.
SGC-NAC-000029	Core sampler hit refusal at 18 inches.
SGC-A61-000043	Sampled 1 foot from flag.
SGC-A61-000047	Drilled to 2 feet due to utilities.
SGC-A61-000048	Drilled to 2 feet due to utilities.
SGC-A61-000049	Relocated due to utilities.
SGC-A61-000051	Core sampler hit refusal at 18 inches.
SGC-A61-000052	Relocated due to utilities; core sampler hit refusal at 18 inches.
SGC-A61-000053	Core sampler hit refusal at 2 feet.
SGC-A13-000056	Core sampler hit refusal at 18 inches
SGC-A13-000058	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-A13-000060	Core sampler hit refusal at 1 foot.
SGC-AOJ-000064	Core sampler hit refusal at 2 - 3 inches.
SGC-AOJ-000066	Core sampler hit refusal at 4 inches.
SGC-AOJ-000067	Core sampler hit refusal at 6 inches.
SGC-AOJ-000069	Core sampler hit refusal at 2 feet.
SGC-A03-000080	Core sampler hit refusal at 20 inches
SGC-A03-000081	Drilled to 2 feet due to utilities.
SGC-A03-000082	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-A03-000083	Sampled 25 feet from original location due to storm sewer; core sampler hit refusal at 18 inches.
SGC-A03-000087	Core sampler hit refusal at 2 feet.
SGC-A21-000088	Core sampler hit refusal at 18 inches.
SGC-A21-000090	Core sampler hit refusal at 20 inches.
SGC-SDB-000097	Relocated due to utilities.
SGC-SDB-000098	Relocated from inside a building.
SGC-SDB-000101	Relocation of SGC-SDB-000099; first location surveyed incorrectly.
SGC-SDB-000102	Relocation of SGC-SDB-000100; first location surveyed incorrectly.

The first six inches of the core, designated for radionuclide analysis, were removed using a clean, stainless steel scoop and placed in a clean stainless steel bowl to be homogenized. Soil was cut from between the 6-inch and 1-1/2 foot depth and placed directly into jars appropriate for volatile organic compound (VOC) analysis, leaving as little headspace as possible. The remaining soil was then placed into another clean stainless steel bowl. If necessary to obtain sufficient sample volume, another core was taken, and the above process was repeated. When enough soil was collected to fill all the sample jars, the contents of both bowls were individually homogenized and used to fill their respective containers. The jars were labeled prior to being filled. Each sample was then secured with a custody seal, sealed in a plastic bag and stored in a refrigerator in Building 19. Radiological samples were delivered to the Mound Environmental Laboratory for screening. Several duplicate radiological samples were collected and set aside for later analysis by the Mound wet chemistry laboratory. After screening clearance was obtained from the Mound Environmental Laboratory, the samples were sealed in coolers and shipped to off-site contract laboratories for analysis. The contract laboratory for radionuclide analysis was Quanterra Environmental Services in Richland, Washington. All other analyses were completed by Roy F. Weston, Incorporated Laboratory in Lionville, Pennsylvania.

Table A.1. Soil Gas Confirmation Detected Volatile Organic Compounds (cont.)

ANALYTE	SGC NAC 000036	SGC NAC 000037	SGC NAC 000038	SGC NAC 000039	SGC A66 000040	SGC A66 000041	Background	10^{-6} Construction Worker Guidelines
VOLATILES (μg/Kg)								
Acetone						88	NA	105000000
1,2-Dichloroethene (total)							NA	21500000
2-Butanone						7 J	NA	46500000
Benzene							NA	8900
Carbon Disulfide							NA	1400000
Chloroform							NA	NA
Chloromethane							NA	NA
Ethylbenzene							NA	480
Methylene Chloride	17	12	12		8	7	NA	NA
Tetrachloroethene							NA	10500000
Toluene		1		1			NA	1250000
Trichloroethene							NA	41000
Xylene (total)							NA	2150000000

The following tables contain the Soil Gas Confirmation Sampling results. Sampling was performed for the following categories of contaminants:

Volatiles
Semivolatiles
PCBs/pesticides
Metals
Radionuclides
Explosives

If no results are given for the contaminant categories listed above, then no detects were found for that category of contaminants.

This page was inserted for clarity. It is not part of the Soil Gas Confirmation Report.

Table A.4. Soil Gas Confirmation Detected TAL Inorganics (cont.)

ANALYTE	SGC NAC 000037	SGC NAC 000038	SGC NAC 000039	SGC A66 000040	SGC A66 000041	SGC A66 000042	Background	10^{-6} Construction Worker Guidelines
INORGANICS (mg/kg)								
Aluminum	15700	7[illegible]	15400	5600	3030	4860	19000	NA
Antimony			0.27 B			[illegible]9 B	NA	425
Arsenic	4.5	8.3	3.1	7.3	3.2	6.4	8.6	320
Barium	97.[illegible]	58.4	122	71.1	19.1 B	37.3 BJ	180	75000
Beryllium	0.[illegible]	0.46	0.[illegible]	0.13 B		0.13 B	1.3	0.7
Bismuth	1.7 B	1.4 B					NA	NA
Cadmium							2.1	1050
Calcium	10100	8[illegible]	3980	158000	189000	18900	310000	NA
Chromium	20.8	1[illegible]	19	7.7	6.7	8 J	20	1050000
Cobalt	13.2 B	7.7 B	13.5	4.9 B	3.3 B	6.1 B	19	NA
Copper	19.4	14.2	[illegible].8	9.7	22.1	13.1 J	26	NA
Cyanide				0.59 B	0.56 B		ND	21400
Iron	309[illegible]	18100	269[illegible]	13800	8300	1450[illegible] J	35000	NA
Lead	11.1	11.2	12.8	23	11.3	9.2 J	48	NA
Lithium	24.6 B	14.2 B	15.8 B	12.3 B	11.7 B	14.3 B	26	NA
Magnesium	4430	29[illegible]	3790	81600	68600	23400 J	40000	NA
Manganese	1120	7[illegible]	1400	596	273	78[illegible] J	1400	135000
Mercury							NC	320
Molybdenum	0.7	1.1 B	[illegible] B	0.9 B	0.62 B	1.6 B	27	NA
Nickel	26.[illegible]	18.1	25.8	9.8	7.6 B	14.8	32	21500
Potassium	2650 B	1160 B	232[illegible]	536 B	562 B	600 B	1900	NA
Selenium						0.4[illegible] BJ	NA	NA
Silver					0.3 B		1700	5500000
Sodium	305 B	165 B	99.8 B	698 B	329 B	1540 J	240	NA
Thallium						0.67 BJ	460	NA
Tin			1.6			4.4 B	20	NA
Vanadium	25.9	17	29[illegible]	12.2	7.1 B	10.4 J	25	7500
Zinc	71.3	47.8	[illegible]1.8	34	46.8	[illegible].1 J	140	320000

Table A.2. Soil Gas Confirmation Detected Semivolatile Organic Compounds (cont.)

ANALYTE	SGC NA[illegible] 00003[illegible]	SGC A66 000040	SGC A66 000041	SGC A61 000042	SGC A61 000043	SGC A61 000044	Background	10^{-6} Construction Worker Guidelines
SEMIVOLATILES (μg/Kg)								
Acenaphthene		130 J	97 J				NA	NA
Acenaphthylene							NA	NA
Anthracene		150 J	110 J				NA	320000000
Benzo(a)anthracene		550	420				NA	4100
Benzo(a)pyrene		570	430				NA	410
Benzo(b)fluoranthene		540	380				NA	4100
Benzo(g,h,i)perylene		400	310 J				NA	NA
Benzo(k)fluoranthene		550	360 J				NA	41000
Bis(2-ethylhexyl)phthalate			4400 D				NA	215000
Butylbenzylphthalate							NA	215000000
Carbazole		180 J	97 J				NA	NA
Chrysene		680	490		23 J		NA	410000
Di-n-butyl phthalate	240					[illegible]4 J	NA	105000000
Di-n-octyl phthalate							NA	21500000
Dibenz(a,h)anthracene		120 J	92 J				NA	410
Dibenzofuran		48 J	35 J				NA	NA
Diethyl phthalate							NA	NA
Fluoranthene		1500	1000	26 J	25 J		NA	42500000
Fluorene		74 J	60 J				NA	NA
Indeno(1,2,3-cd)pyrene		370 J	290 J				NA	4100
2-Methylnaphthalene							NA	NA
Naphthalene		26 J	26 J				NA	NA
Phenanthrene		1100	720		25 J		NA	NA
Phenol							NA	650000000
Pyrene		1200	880	21 J	30 J		NA	32000000

Table A.6. Soil Gas Confirmation Detected Radionuclides (cont.)

ANALYTE	SGC NAC 000036	SGC NAC 000037	SGC NAC 000038	SGC NAC 000039	SGC A66 000040	SGC A66 000041	SGC A66 000042	Background	10^{-6} Construction Worker Guidelines
RADIONUCLIDES (pCi/g)									
Americium-241								ND	4.95
Bismuth-207								ND	0.175
Bismuth-210								ND	NA
Cesium-137		0.305	0.600				0.201	0.42	0.46
Cobalt-60								NC	0.1
Plutonium-238	0.19[illegible]	1.53	0.[illegible]	0.144	0.264	0.0496	0.937	0.13	5.5
Plutonium-239/240		0.00848	0.00898					0.18	5.5
Potassium-40	18.7	19.8	17.7	24.[illegible]	9.55	18.2	[illegible]	37	NA
Radium-226	1.26	1.2[illegible]	0.983	[illegible]	0.432	0.834	0.635	2	0.14
Thorium-228	1.50	1.0[illegible]	1.05	0.987	0.319	0.755	1.01	1.5	0.85
Thorium-230	1.27	[illegible]12	1.23	1.24	0.416	1.10	0.578	1.9	44
Thorium-232	1.[illegible]	1.06	1.[illegible]	1.08	0.380	0.873	1.[illegible]	1.4	50
Uranium-234	1.02	1.02	0.[illegible]99	0.853	0.477	0.811	0.4[illegible]	1.1	37.5
Uranium-235	0.0656	0.0504	0.0493	0.0[illegible]6				0.11	3.35
Uranium-238	1.05	1.15	1.13	1.02	0.444	0.918	0.602	1.2	11